Dissertation on

AN ANALYTICAL STUDY OF RHEGMATOGENOUS RETINAL DETACHMENT

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CERTIFICATE

This is to certify that the dissertation entitled **"AN ANALYTICAL STUDY OF RHEGMATOGENOUS RETINAL DETACHMENT"** submitted by Dr**. K. KAVITHA** in partial fulfillment for the award of the degree of Master of Surgery in Ophthalmology by The Tamilnadu Dr.M.G.R.Medical University, Chennai is a bonafide record of the work done by her in the Regional Institute of Ophthalmology, Government Ophthalmic Hospital, Egmore, Chennai, during the academic year 2008-2011.

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PART II

INTRODUCTION

A retinal detachment is not really a detachment of the complete retina, but rather the separation of the neural component from the pigment component. The neural retina can be pulled off by the vitreoretinal traction or raised by exudation or by a tumour, but damage most commonly occurs when a break in its surface permits liquefied vitreous to pass from the vitreous cavity into the potential space that exists between the two retinal layers.

A break in the retinal surface alone is not enough to give rise to detachment. Fluid can only collect beneath the neuroretina if it is both available and has access to retinal break. Such circumstances arise when the vitreous gel collapses and separates the posterior vitreous cortex from the retinal surface. Aetiologically, retinal breaks may result either from some induced weakness in the retina itself or from some apparent interplay between the retina and the vitreous.

HISTORICAL BACKGROUND

1722 Maitre Jan &1740 Morgagni	:	Noted total retinal detachment in the eye of a dead cow
1704 Mery	:	First did ophthalmoscopic examination of a normal fundus in a cat
1766 Morgagni	:	Described retinal detachment in a case of ocular trauma
1841 Sichel	:	Described retinal detachment as white vascularised membrane seen through pupil
1851 Von-Helmholtz:		Reinvented the direct ophthalmoscope
1852 Ruete	:	Invented the indirect ophthalmoscope (uniocular variety)
1853 Coccius	:	Noted the retinal tears and holes but overlooked their significance
1853 Arlt and 1854Von graefe	:	Proposed theory of exudation & disturbance in choroidal circulation
1857Von graefe	:	Put forward theory of distension of globe
1858 Mueller	:	Proposed theory of traction
1861 Stellwag	:	Put forward theory of hypotony and advised bed rest
1863 Von-Graefe	:	Dissected a vitreous membrane with a needle

1869 Iwanoff : Described that PVD preceded RD

1870 De-Wecker and Jaeger : Thought that retinal breaks caused RD

1882 De-Wecker : Used Galvano cautery to create aseptic chorioretinal adhesions but treatment was away from break

1900 Tranta : Examined the retinal periphery with thumbnail as sclera depressor

1906 Dufour and Gonin : Revived Leber's theory that retinal breaks caused retinal detachment

1911 Ohm : First performed intravitreal air injection

1911 Gullstrand : Developed the optical principles of slitlamp biomicroscope

1918-1925 Jules Gonin :

Proposed that spontaneous detachment of retina was associated with a hole in the retina and stressed that RD could be cured only if the break is sealed. Attempts to close retinal breaks by applying heat and chemicals in the region of the hole by ignipuncture. This immediately raised the success rate from 1 in 1000 to 1 in 1.2

1924 W.Lister : Proposed that in the presence of hole reattachment does not occur

1929 Vogt : Employed Galvano cautery for chorioretinal adhesion

1933 Deutschmann: Described cryo surgery

1937 Jess : First to buckle the area overlying retinal breaks by suturing a gauze piece over the sclera

1938 Rosengren : Reported the use of intravitreal air with SRF drainage

1942 Hruby : Described a pre corneal concave lens for fundus examination

1947 Schepens : Father of the modern RD surgery. Popularised and perfected the Indirect ophthalmoscopy and scleral depression

1953 El-Bayadi : Described a pre corneal lens for fundus examination

1953Ernst custodis: Popularised Scleral buckling and indentation

1956 Meyer : Invented Xenon arc photocoagulation Schwickerath

1957 Schepens : Introduced encirclage with solid silicone implants and radiofrequency diathermy

1957 Goldmann : Invented three mirror lens

1958 Custodis : Used a plomb over retinal break and did not drain SRF

1957-58 Arruga : Used supramid thread as encirclage

1960 Maimen : Introduced the first ruby laser

1962 Cibis : Injected silicon oil

1965 Lincoff : Refined custodis' technique by using silicon explants and introduced cryotherapy in retinal surgery as a substitute for diathermy

1967 Rutnin : Described normal fundus periphery

1969 Kasner : Performed first open sky vitrectomy

1971 Machemer : Described the procedure of vitrectomy through Vitreous Infusion Suction Cutter

1972 Lincoff : Introduced silicon sponge and advocated cryo and gave tips for finding the retinal hole

1973 Norton : Described intravitreal SF_6 injection

1976 Lincoff : Described retinal buckling

1978 Machemer : Established the role of retinal pigment epithelial cell migration in cases of proliferative vitreoretinopathy

1979 Lincoff : Used temporary balloon buckle

1980 Lincoff et al : Described the properties of perfluorocarbon

1983 Retina society Terminology Classification of PVR got introduced

1984 Hilton & Grizzard :Introduced the term pneumatic retinopexy

1990 : BIOM was introduced

1991 Higginbotham: Introduced 25 Gauge Parsplana Sutureless Vitrectomy

EMBRYOLOGY

Rudimentary eyeball develops as an ectodermal diverticulum from the lateral aspect of forebrain. The region of neural plate which is destined to form prosencephalon shows a linear thickened area on either side and further depressed to form optic sulcus which deepens to form optic vesicle. During 4^{th} week of gestation optic vesicle is converted into double layered cup. 2 layers of optic cup give rise to

1. Neurosensory retina from the inner wall

2. Retinal pigment epithelium from the outer wall

During 4^{th} to 5^{th} week the optic vesicle is differentiated into outer nuclear zone and inner marginal zone devoid of nuclei. Inner wall is differentiated into outer and inner neuroblastic layers with transient layer of cheivitz in between. Inner neuroblastic layer differentiates to form ganglion cells, muller cells and amacrine cells. Outer neuroblastic layer differentiates to form photoreceptors, bipolar cells and horizontal cells. Photoreceptors are thought to be derived from cilia found in outer nuclear zone.

Outer wall of optic cup initially consists of pseudostratified ciliated columnar epithelium. Mature RPE shows simple cuboidal epithelium. Melanogenesis commences at 6 weeks of gestation. All layers of retina are formed by 5½ months of gestation.

ANATOMY

Retina extends from the optic disc to the ora serrata.The outer surface is in contact with the Bruch's membrane& the inner surface is in contact with the vitreous body. Retina extends anteriorly 6mm from the limbus on the medial side and 7mm from the limbus on the lateral side.

THE LAYERS OF RETINA FROM WITHOUT INWARDS

- The pigment Epithelium
- The layers of rods and cones
- The External limiting membrane
- The Outer Nuclear layer
- The Outer plexiform layer
- The Inner nuclear layer
- The Inner plexiform layer
- The Ganglion cell layer
- The Nerve fibre layer
- The Internal limiting membrane

The two principle attachments are at the disc where all nerve fibers enter and continue as optic nerve and at the ora serrata.

BLOOD SUPPLY OF RETINA

It is from two sources. The direct branches from the central retinal artery supply the inner retinal layers till the outer plexiform layer, while diffusion from the choroidal vessels supplies the outer retinal layers. In retinal detachment there occurs separation of the neural retina from the underlying choroidal vascular supply leading onto outer retinal degeneration.

OPHTHALMOSCOPIC DIVISION OF RETINA

Grossly it is divided into two distinct regions separated by equator:

a. Posterior pole and b. Peripheral retina

POSTERIOR POLE

It is the area of retina situated posterior to the equator.

It includes two distinct areas: Optic disc and macula lutea

Optic disc

It is the circular area of 1.5 mm in diameter where all the retinal layers terminate except the nerve fibers which continue as the optic nerve. The central depressed part is the optic cup through which central retinal artery and vein emerge.

Macula lutea

It is about 5.5 mm in diameter. Fovea centralis (1.85mm in diameter) is the central depressed and most sensitive part of the macula.. Foveola forms the floor of the fovea and it is situated about 2 disc diameters from the temporal margin of the disc and 1mm below the horizontal meridian.

PERIPHERAL RETINA

It extends from equator to ora serrata.

APPLIED ANATOMY

EQUATOR

Surgical anatomy

The anatomical equator is an imaginary line located just anterior to the exit of vortex veins

ORA SERRATA

The ora serrata is the junction between the retina and ciliary body. The nasal ora is characterized by tooth-like extensions of retina onto the pars plana (dentate processes) which are separated by oral bays. In the temporal ora the dentate processes are blunt or absent.

Surgical anatomy of ora serrata

Externally the ora corresponds to the insertions of the rectus muscles. In the emmetropic eye this is located 7mm behind the limbus temporally and 6mm nasally.

PARS PLANA

The ciliary body is located 1mm from the limbus and extends posteriorly for about 6mm. The first 2mm consists of the pars plicata and the remaining 4mm consist of the flattened pars plana.

Surgical anatomy

In order not to endanger the lens or retina, the ideal location for surgical incisions is the mid-pars plana, which is located 4mm from the limbus.

VITREOUS BASE

The vitreous base is a 3-4mm wide zone that straddles the ora.

Surgical anatomy

The collagen fibres of the vitreous are exceptionally dense and strongly adherent to the posterior pars plana and perioral retina. An incision through the mid-part of the pars plana (4-5mm from the limbus) will usually be located anterior to the vitreous base.

VITREORETINAL ADHESIONS

NORMAL

In the healthy eye the peripheral cortical vitreous is loosely attached to the ILM of the sensory retina. Stronger attachments occur at the following sites:

1. Vitreous base – very strong
2. Optic disc margin – fairly strong
3. Around fovea – fairly weak
4. Peripheral blood vessels – usually weak

ABNORMAL

Occasionally the following abnormally strong vitreoretinal adhesions are associated with retinal tear formation in eyes with acute PVD

1. Posterior border of lattice degeneration
2. Congential cystic retinal tufts
3. Retinal pigment clumps
4. Peripheral blood vessels
5. Vitreous base anomalies – such as posterior tongue-like extensions and isolated islands
6. Areas of ‘white with pressure’ and ‘white without pressure’

FUNDUS LANDMARKS

LONG POSTERIOR CILIARY ARTERIES

The arteries accompanied by nerves are recognized as yellow lines that start behind the equator and run anteriorly in the 3 and 9 o’clock meridian.

Surgical anatomy

The arteries run in the suprachoroidal space in line with the horizontal recti. Because the arteries supply the anterior uvea, obstruction to blood flow by a tight encircling band may result in anterior segment ischaemia.

SHORT CILIARY NERVES

They appear as peripheral yellow lines

VORTEX VEINS

The vortex ampullae are located just posterior to the equator in the 1, 5, 7, and 11 o'clock meridia.

Surgical anatomy

Externally the vortex veins emerge at varying distances from the equator. Occlusion of the veins by tight encircling band will cause congestion of the anterior segment.

PHYSIOLOGY OF RETINAL APPOSITION

Mechanical forces inside subretinal space

- Adhesive forces created by the proteins, glycoproteins and proteoglycans in the interphotoreceptor matrix
- Interdigitation of outer photoreceptors with numerous microvilli on the inner surface of RPE
- Ability of RPE to remodel its apical segment by microtubules and microfilaments in correspondence with the photoreceptors

Mechanical forces outside subretinal space

- Oncotic pressure gradient across the subretinal space
- Hydraulic force of the IOP tends to flatten the retina against RPE

Metabolic factors

- Active metabolic transport of fluid and ions by the RPE pump

MORPHOLOGICAL CHANGES AFTER DETACHMENT

- Retraction of apical processes of RPE microvilli
- Proliferation and migration of RPE cells into subretinal space
- Degeneration and death of photoreceptor outer segments
- Muller cell hypertrophy

SRF SOURCE

1. Plasma from choriocapillaries across the RPE
2. Vitreous from fluid movement through the retinal hole. This depends on the size of the hole or break and state of vitreous gel over the hole.
3. From retinal degenerating elements

EFFECT ON IOP

RD is associated with hypotony because

1. Reduced aqueous humour formation due to low grade iridocyclitis
2. Posteriorly directed aqueous flow. An intraocular shunt is created between aqueos humour secreted by the ciliary epithelium and fluid transported across the RPE.

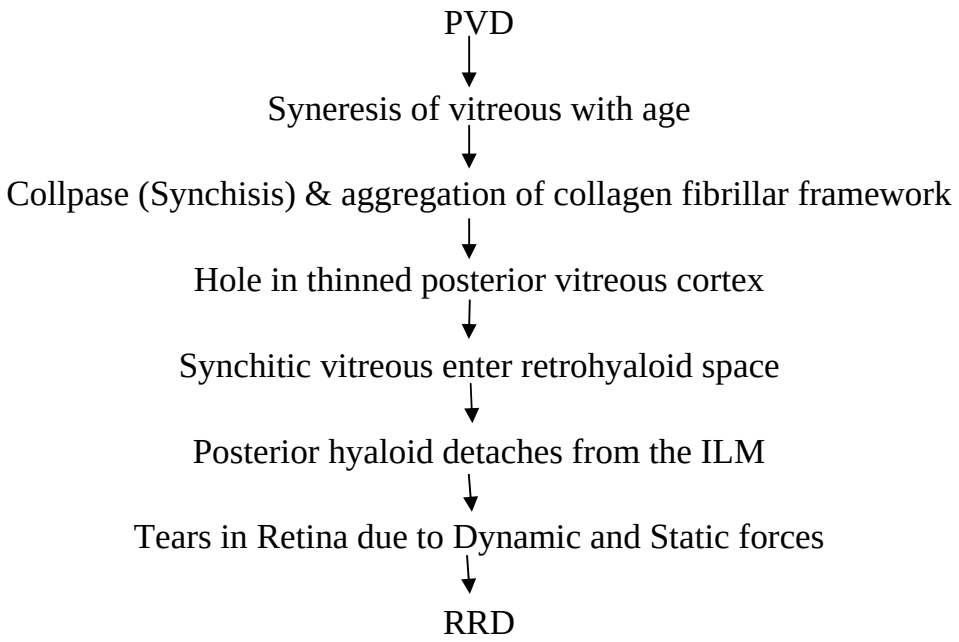
PATHOGENESIS

Acute Rhegmatogenous PVD with collapse is the predisposing factor of RD. Prerequisites for rhegmatogenous RD are

1. Liquified vitreous gel

2. Presence of retinal break

3. Tractional forces that precipitate break



FORCES THAT CAUSE TRACTION ON THE RETINA

1. Gravitational forces on the vitreous gel attached to the retina
2. Dynamic forces transmitted from vitreous to the retina
3. Contraction of the vitreous gel at site of vitreoretinal attachment
4. Contractile fibro cellular membrane on the surface of the retina posterior to proliferative vitreoretinal changes.

RETINAL BREAKS

A retinal break is a through and through full thickness break in the neurosensory retina connecting the vitreous cavity with the potential space between the neurosensory retina and the RPE. Breaks can be classified according to pathology, morphology & location.

1. PATHOGENESIS

A.Tears - due to vitreoretinal traction
– predilection for upper fundus due to gravitational force

B. Holes - caused by chronic atrophy of sensory retina
– predilection for temporal fundus

2. *MORPHOLOGY*

A. U tears (horseshoe, flap and arrowhead)

It has two anterior horns running forward from the apex which is pulled anteriorly by the vitreous. Base remains attached to the retina.

B. Incomplete U tear (linear, J shaped, L shaped)

C. Operculated tear - flap is completely torn away from the retina

D. Dialyses - These are circumferential tears along the ora with vitreous gel attached to the posterior margin

E. Giant tears - Involves $\geq$ 90 degree circumference of the globe

3. According to LOCATION

1. Oral 2. Postoral 3. Equatorial

4. Postequatorial 5. Macular

AETIOLOGY

1. *DEGENERATIVE CHANGES*

The major pre-disposing degenerations are Lattice degeneration, Snailtrack degeneration, cystic retinal tufts, degenerative retinoschisis, focal pigmental clumping, Diffuse chorioretinal atrophy and paravascular vitreoretinal attachments.

2. *MYOPIA*

Over 40% of all detachments occur in Myopes. Degree of myopia is directly related to RD which tends to be the greatest between the limits of 8D and16 D. Myopia predisposes to RD by:

a. Increased incidence of significant peripheral degeneration

b. Early vitreous degeneration and PVD

c. The thin retina of a myope being more prone for breaks

d. Interphotoreceptor matrix may be deficient

3. TRAUMA

Blunt trauma compresses the globe along its anteroposterior diameter and expands it in the equational plane. This traction is usually strongest at the posterior border of the vitreous base and results in a linear tear. Blunt trauma can also cause irregular retinal break at the macula.

Penetrating injury is associated with RD and it is 4 to 5 times common if vitreous haemorhage is present. The site of actual penetration will produce a hole in the retina.

4. CATARACT SURGERY

Predisposing factors for RD in cataract surgery are:

- Vitreous loss during cataract surgery
- Pre existing lattice degeneration
- Axial length > 26 mm with myopic status
- Nd – YAG capsulotomy
- Post Operative trauma
- Posterior Vitreous Detachment
- H/O RD in fellow eye
- Family history of RD

The factors those are responsible for facilitating RD after complicated Cataract surgery are

a. Depletion of hyaluronic acid from vitreous allows collagen fibrils to aggregate thus precipitating PVD and RD
b. Vitreous moves slightly forwards exaggerating pre-existing vitreoretinal traction causing RD in pre-existent breaks
c. Traction on extreme periphery which has tiny breaks

Aphakics differs from pseudophakics in having

- Multiple small U shaped tears
- Upper nasal breaks
- More chance of total detachment because of faster spread of SRF

Significant features in pseudophakia

- Increased incidence of RD within one year of cataract surgery because they experience symptoms faster
- Single posterior tear is common
- Factors causing poor visualization of fundus are inadequate pupil, posterior capsular opacity, IOL surface deposits and vitreous opacities following inflammation
- Typically present with macula off detachment

4. YAG CAPSULOTOMY

With YAG capsulotomy 47% to 59% of detachment tends to occur within 3 months of the procedure. YAG capsulotomy facilitates RD by

- Physiochemical changes in the vitreous leading to degeneration
- Shock waves generated are detrimental
- Posterior capsular tamponade lost

CONGENITAL EYE ANOMALIES

A. Choroidal Coloboma

Breaks can occur at the edge of the coloboma

B. Congenital lens Coloboma

May be associated with giant retinal tear

C. Marfan's, Ehler Danlos Syndrome

Mesodermal dysgenesis affecting vitreous and mucopolysaccharides

INCIDENCE

- 40% cases of Retinal detachment are High myopes
- 40% cases are associated with lattice degeneration
- 30% patients are aphakic

- 10% patients are associated with trauma
- 1-2% of uncomplicated post cataract patients develop RD. The risk is increased to7% if associated with vitreous loss.
- Postoperative patients comprise about 30% of RD
- Males are affected more than females in the ratio 3:1.
- Family history of RD is a significant risk factor.

CLINICAL FEATURES

SYMPTOMS

1. **Flashes (Photopsia)**

   It occurs due to irritation of photoreceptors caused by VR traction

2. **Floaters (Muscae Volitantes)**

   They are moving vitreous opacities. It signifies presence of tear.

   It may be like a weiss ring, cobwebs or shower of small spots.

3. **Field Defect**

   It is often perceived as a “Black Curtain”due to spread of SRF.

4. **Failing Vision**

   Due to SRF detaching the macula or by obstruction of the visual axis by a large bullous RD hanging over the fovea

5. **Inverse Diplopia**

   Especially seen in Giant tears and dialyses where the margin of the

tear rolls over and inverts itself

SIGNS

1. Visual acuity depends on the macula which may be detached or covered by a overhanging bullous RD
2. Visual field will show relative scotoma
3. Marcus gunn pupil may be present in extensive RD
4. Mild anterior uveitis is a common finding.
5. IOP is most often decreased by 5 mm of Hg. RD with raised tension occurs in Blunt trauma, tumour with RD, uveitis, obstruction of trabecular meshwork by inflammatory cells, pigment granules and photoreceptor segment(Schwartz syndrome)
6. Red reflex is altered and appears grey
7. Detached retina is convex, corrugated and grey with undulating movements. Retinal vessels appear dark and tortuous. Retinal breaks appear as discontinuities in the retinal surface.
8. Tobacco dusting (Shaffer's sign)-Pigment cells in the Anterior vitreous is strongly suggestive of a retinal break
9. Weiss' ring may be seen

PROLIFERATIVE VITREORETINOPATHY (PVR)

Here cells proliferate on either or both surface of the retina and on the vitreous strands and then contract producing stiffening and folding of retinal surface. The membrane is derived from dedifferentiated RPE cells, fibroblasts, glial cells, macrophages and myofibroblasts. PVR has predilection for the inferior retina.

Retina society classification of RD with PVR (1978)		
A	Minimal	Vitreous haze, Vitreous pigment clumps
B	Moderate	Wrinkling of inner surface, rolled edge of break, retinal stiffness, vessel tortuosity
C	Marked	Full thickness retinal fold C1 One Quadrant C2 Two Quadrant C3 Three Quadrant
D	Massive	Fixed retinal folds in four quadrants D1 Wide funnel D2 Narrow funnel D3 Closed funnel where ONH is hidden

Retina society classification of RD with PVR (1983)	
A	Vitreous Haze, clumps, pigment clusters in vitreous
B	Wrinkling of inner surface, stiffness, tortuosity, rolled edges and decreased vitreous mobility
C	1-12 clock hours, focal, diffuse, circumferential full thickness folds and subretinal strands CP-Posterior to equator CA-Anterior to equator

DIFFERENTIAL DIAGNOSIS

1. RETINOSCHISIS

In the acquired variety there are two forms

(a) Typical where the division in the neurosensory retina is at the level of outer plexiform layer

(b) Reticular variety where the division is at nerve fibre layer.

Symptoms

- Photopsia and floaters are absent

Signs

- Elevation is convex, smooth,thin and immobile
- Breaks may be present in one or both layers

Juvenile X linked retinschisis is a congential, X linked recessive condition where the neurosensory retina is split at the NFL.

2. *CHOROIDAL DETACHMENT*

Symptoms

- Photopsia and floaters are absent

Signs

- Low IOP and shallow AC
- Convex, brown, smooth and relatively immobile elevation which does not extend posterior to the equator

3. *SECONDARY RETINAL DETACHMENT*

a. EXUDATIVE RD

Mainly seen in choroidal tumours, posterior uveitis as in Harada's disease, Retinoblstoma, Posterior Scleritis, Coats disease, Eales disease, Senile Exudative maculopathy, and following cryopexy or diathermy

b. TRACTIONAL RD

Characterised by concave detached retina with the peak attached to the tractional band. Usually seen in PDR, ocular trauma, ROP, PHPV, Sickle cell retinopathy, Toxocariasis and Parsplanitis.

MANAGEMENT

PREOPERATIVE

1 History with relavance to symptoms of flashes / floaters, H/o trauma, myopic status, diabetic status, family H/o RD is essential

2. Anterior segment examination noting down phakic status, intactness of posterior capsule, tobacco dusting of anterior vitreous, fine Iris new vessels, and pupillary assessment is mandatory

3. Recording of visual parameters like visual acuity, visual field, IOP, refractive status of the eye should be done.

4. Detailed posterior segment examination by all the possible modalities with diagrammatic representation in the fundus chart is the first and foremost objective in managing a RD case.

EXAMINATION OF THE FUNDUS

Direct Ophthalmoscopy

It can be used for finer detail examination of posterior pole

Indirect Ophthalmoscopy

IDO under full mydriasis is the most ideal method of examination. Stereopsis, increased field of view and comfortable

distance from the patient to draw the fundus diagram simultaneously are the advantages. The technique of scleral depression is essential to examine the ora serrata region. The depressor should always be held tangential to the globe.

Slit Lamp Biomicroscopy

It is the ideal form for examination of the posterior pole using noncontact or contact lenses with advantage of stereopsis.

TO LOCALISE A PRIMARY BREAK

Lincoff's rule may be used to identify the quadrant of possible break according to the configuration of SRF. Break may be difficult to detect in large bullous retinal detachment due to elevation and at times when it is hidden between folds.

SPECIAL TECHNIQUES

1. FUNDUS Photograph :

Performed for documentation

2. ULTRASONOGRAPHY :

RD echo should be separated from the choroid by at least 1.5mm. Total RD has insertion at ora serrata and disc. It has 100% reflectivity

with moderate after movement while PVD shows freely mobile membranous echo of uneven thickness & reflectivity with variable attachment to ONH and retina with maximum after movement.

Longstanding retinal detachment with PVR can be detected by B-scan.

Scan Mode	***RD***	***CD***	***PVD***
B scan	• Attached to nasal, temporal ora, ONH. • Restricted after movement which depends on duration of RD and PVR	• No Disc insertion. Thick dome shaped in periphery & does not extend beyond equator • Little after movement	• Freely mobile membranous echo of uneven thickness & reflectivity with variable attachment to ONH and Retina. • Maximum after movement
A scan	100% spike	Double peak or 'M' spikes	Low to medium spikes

3. ERG :

In RD it is subnormal or extinguished. But is a generalized response and small localized detachment may be missed.

4. Fundus Flourescein Angiography :

Has a role in Choroidal tumour or metastasis with Exudative RD.

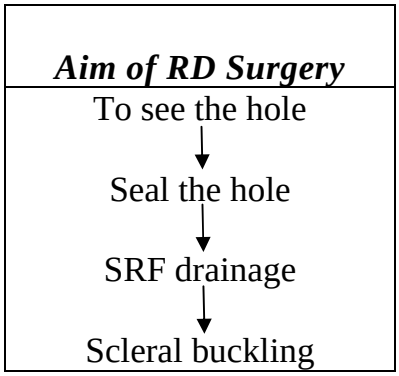
BED REST

It is advocated

- To prevent macular involvement by SRF especially in cases of superotemporal retinal detachment
- To promote spontaneous resorption of SRF in fresh breaks
- To unroll the mobile posterior flap of GRT

SURGERY

"Every retinal tear has its detachment and every detachment has its tear" was the dictum enunciated by Gonin. The aim of RD surgery is to reattach the retina as quickly as possible by the most effective and least traumatic method with permanent closure of all retinal breaks.



A. SURGICAL EXPOSURE

360 degree conjunctival peritomy with horizontal relaxing incisions are necessary for adequate field exposure.

B. VISUALISATION AND MARKING OF THE BREAK

Ontable reassessment of the detachment is necessary. By indenting the sclera with squint hook approximation of the retinal break to the RPE should be tried.

Protocol for marking the hole before applying cryo

- Atrophic round hole - Single posterior edge mark
- Small Flap tear - Single posterior edge mark
- Large flap tear - Each of two anterior horns and single posterior edge mark
- Multiple breaks close together - Most posterior break mark or posterior single edge mark
- Bullous RD - Parallax Occurs. So put first mark over the least elevated area
- Areas of prominent VR traction and lattice degeneration that to be supported by the scleral buckle also should be marked

C. METHODS TO PRODUCE CHORIORETINAL ADHESION

1 .Photocoagulation

Laser can be applied through a slitlamp delivery system, Laser indirect ophthalmoscopy and Endolaser. Flat retina and clear media are prerequisites. It causes less breakdown of blood ocular barrier.

The lasers currently available are:

Gas lasers	***Solid State***
Argon	Ruby
Krypton	Nd YAG
Helium Neon	Tunable dye
CO_2	Diode

2. Cryopexy

High pressure Nitrous Oxide or CO_2 can be used. It works on principle of Joule Thomson effect. Cryoprobe of diameter 2 to 2.5mm is used. Retinal cryoprobe should reach temperature of -89˚C. End point is retinal whitening. The goal is to surround 1-2 mm around the break. Small retinal break and atrophic holes are treated with single freeze centred on the break.

3. Diathermy

Utilises 13.56 MHz high frequency alternate current to generate heat in the tissues due to electrical resistance. Uniform scleral dissection is necessary. Applications are made in rows of 2 mm apart and parallel to the equator for 3-5 seconds duration. Diathermy burns leave 1mm mark. This procedure is now obsolete.

Comparison between cryopexy and diathermy

Cryopexy	***Diathermy***
1. No scleral shrinkage	1. Scleral shrinkage can occur
2 . Doesn't damage vessels Can be applied over staphyloma	2 If sclera thickness is nonuniform choroidal and retinal bleeding will occur
3. Can be applied even in wet sclera 4. Spots should be contiguous	3.Dry scleral surface is needed 4. It need not be contiguous

Development of Chorioretinal adhesion

For photocoagulation – Effect starts in 24 hours & increases rapidly in 1week.

For diathermy and cryo - Takes several days to start

- attains maximum strength after 2weeks

D. METHODS TO PRODUCE RPE AND NEUROSENSORY RETINAL APPOSITION

The methods available are:

1. Scleral buckling
2. Pneumatic retinopexy
3. Vitrectomy with Internal tamponade
4. Combination of internal and external procedure

1. Scleral Buckling

The advantages of this procedure are:

1) Relief of vitreoretinal traction due to effective reduction in the diameter of globe by encirclage.
2) Functionally closes breaks by opposing them to the vitreous on inside and to the RPE on the outside.
3) Creates a false ora serrata.
4) Holes not identified will even be inadvertently sealed.

Materials used

Ideal buckling should be soft, non toxic, non allergic, easy to mould, can be sterilized and cut to different shape.

Types of Buckle	
Non - absorbable	▪ Solid silicone rubber ▪ Silicone sponge ▪ Hydrogel
Absorbable	▪ Gelatin ▪ Biological- Donor Sclera, fascia lata, temporalis fascia, Achilles tendon, duramater ▪ Synthetic materials Polythene, Polyvinyl Teflon meshes, Arruga suture(supramid suture)

Silicon rubber : made up of cross linked dimethyl siloxane

Silicone sponge : made up of silicon rubber with air filled pores but more compressible and elastic. Buckle created is extensive, high and smooth. May be round or oval in cross section.

Hydrogel : Combines the advantage of both rubber and sponge. It is soft, elastic, microporous; smooth surfaced and can be heat sterilized. Postoperatively it swells up giving additional heightening of the buckle

The mode of placement

Ideally the entire break should be surrounded by about 2mm of buckle. The buckle is either implant or explant. Implant is the placed after thin sclera dissection with no exposure. Explants are placed over the sclera.

The nature of the explants can be

Radial	**Segmental Circumferential**	**360˚ encirclage**
Placed at right angle to the limbus	For dialyses and GRT	Breaks of 3 or more quadrants
Medium to large holes	Multiple breaks located in one or two quadrants	Lattice degeneration involving three or more quadrants
Horse shoe tear for supporting the tear in its long axis	Anterior breaks	Extensive retinal detachment without detectable breaks
Posterior breaks	May be 180˚ or 270˚	Milld PVR
When there is risk of postoperative fish mouthing		Failed local procedure

Suturing methods:

Mattress sutures with nonabsorbable materials such as polyester, nylon or polypropylene are placed a minimum 2mm further apart than the width of the sclera element. The vortex veins must be avoided. The suture is passed ½ to ¾ depth of sclera. Radial tire is placed in such a way that the posterior edge of the break lies on its posterior crest.

Encirclage ends are secured by

Watzke's sleeve, Tantalum clips

Clove hitch nonabsorbable suture

E.MANAGEMENT OF SRF

The rationale is to diminish intraocular volume so as to allow elevation of the buckle and to bring together the RPE and the neurosensory layer.

Indications for SRF drainage

- Difficulty in localisation of breaks especially in a bullous RD
- Old retinal detachment with very viscous subretinal fluid
- Inferior equatorial tear
- Immobile retina
- Eyes with raised IOP

The DACE (Drainage + Air + Cryo + Explant) technique favours early SRF drainage. Preplaced sutures have to be placed. Drainage is done through radial sclerotomy at the site of maximum detachment or usually just beneath horizontal recti avoiding the vessels. External drainage is done with 26 gauge needle attached to a syringe. SRF drained passively. Then inject air into vitreous cavity followed by cryo and external buckling. In Internal procedures subretinal fluid may be drained by retinotomy with endodiathermy or diode red/argon laser.

COMPLICATIONS OF SURGERY

INTRA OPERATIVE COMPLICATIONS

A. Epithelial edema

Occurs due to raised IOP. The epithelium may be damaged by dessication during the procedure. Mild epithelial edema is treated with topical glycerine. Extensive edema requires debridement.

B. During diathermy

1. If the sclera surface is wet diathermy is difficult to apply
2. Occlusion of the vessel may occur following accidental diathermy over a long posterior ciliary artery.

C. During Cryotherapy

1. Inadvertent freezing of the lids may occur
2. Premature removal of cryoprobe may result in choroidal haemorrhage and scleral rupture
3. Freezing over a prominent vessel running in the operculum may result in haemorrhage
4. Choroidal haemorrhage may occur if cryo is applied in the region of the vortex veins. Excessive cryotherapy due to over-freezing or repeated freezing of the pigment epithelium leads into pigment dispersion. This is implicated in the causation of PVR
5. Intraocular penetration of sclera through weak sclera

D. Miosis

It may result from inflammation caused by excess cryo or hypotony caused by rapid drainage of subretinal fluid

E. During buckling and scleral suturing

1. Corneal clouding may occur
2. Accidental drainage of SRF can occur while taking scleral sutures
3. Damage to vortex veins can occur during placement of scleral sutures
4. Globe perforation rarely occurs while taking scleral bites

5. During lamellar scleral dissection if the flap taken is thin, the mattress sutures holding the flaps over the implant may tear out of the flaps or the flap may tear from the sclera
6. Unintentional perforation of the scleral bed may occur.
7. Prolonged elevation of IOP above the systolic pressure following excessively tight scleral buckle leads to CRAO.

F. SRF drainage complications

1. Dry tap results from failure to completely perforate the choroid
2. Choroidal haemorrhage may occur at the time of perforation and release of SRF or after fluid has been drained. It can be managed by tightening of sutures over the buckle to increase IOP and prevent further bleeding.
3. Ocular hypotony results in rupture of large choroidal vessel & miosis. Hence rapid evacuation of SRF is to be avoided.
4. Iatrogenic break may occur due to accidental perforation of retina
5. Vitreous prolapse may occur when SRF is drained near large break at the site of flat retina.
6. Damage to long posterior ciliary arteries and nerves will occur if SRF drainage is done under the horizontal recti.

POST OPERATIVE COMPLICATIONS

EARLY COMPLICATIONS

1. Oedema of the periocular tissues *:*

Oedema of the periocular tissues with pain is common result of cryotherapy and also due to amount of tissue handling during surgery.

2. Persistent detachment :

The causes for persistent detachment are

(a) Unsealed retinal break due to improper cryo application and placement of buckle.

(b) Posterior breaks which are very difficult to reach by cryoprobe

(c) Missed breaks

3. Anterior Segment ischemia:

This is caused by poor perfusion of the anterior segment caused by tight narrow posterior encircling band or when more than one rectus muscle have been disinserted.

4. Sterile Uveitis:

Due to either excessive surgical trauma or to excessive cryopexy.

5. Vitritis :

Due to excess application or involving large areas of cryopexy.

6. Choroidal detachment :

It is caused by transudation of choroidal fluid into the suprachoroidal space. The most common predisposing factor is prolonged severe ocular hypotony following drainage of large volume of SRF. Usually it resolves spontaneously within 2 weeks.

7. Endopthalmitis

8. Secondary angle-closure glaucoma :

A tight encircling procedure can obstruct the vortex veins causing anterior rotation of the ciliary body in pre-existing shallow AC.

LATE COMPLICATIONS

1. Recurrent retinal detachment :

Late failure is defined as initial attachment of retina and subsequent redetachment. The causes are

(a) PVR (b) New break formation (c) Reopening of retinal break from inadequate chorioretinal reaction slippage of plomb, spontaneous extrusion of the buckle and removal of buckle due to infection or exposure

2. **Buckle extrusion and infection**

3. **Migration of the encircling strap**

4. Ocular motility disturbance :

This occurs especially if the rectus muscle has been disinserted or large explants have been placed under them.

5. Maculopathy :

Following surgery the macula may be damaged in a no. of ways

a) Cellophane maculopathy or macular pucker may occur

b) Cystoid macular edema is less common

c) Macular degeneration will occur with longstanding detachment

d) Pigmentary maculopathy resulting from excessive cryotherapy

e) Atrophic maculopathy is usually secondary to gravitation of blood in the subretinal space from intraoperative choroidal haemorrhage

6. Refractive changes :

Segmental buckle produces astigmatism. Encircling bands produce mild myopia.

7. Extraocular muscle imbalance due to one of the following :

a. Insertion of a large plomb

b. Accidental disinsertion or rupture of rectus muscle

c. Excessive conjunctival scarring

INDICATIONS FOR PROPHYLACTIC THERAPY

1. Fellow eye retinal detachment
2. Family history of retinal detachment
3. Symptomatic tear with flap in a nonfellow phakic eye
4. Any break usually a flap with manifest traction on the edge in nonfellow phakic eye
5. Superotemporal breaks which might threaten the macula
6. Widespread lattice particularly with multiple round holes encircling the retina along the equatorial line
7. Subclinical RD- SRF extending more than 1 disc diameter on all sides that does not extend posterior to equator
8. Break in an aphakic eye

PNEUMATIC RETINOPEXY

It is an outpatient office procedure. The goal is to tamponade break by injecting a gas bubble into vitreous cavity combined with chorioretinal adhesion. It can be done either as a single session along with cryotherapy or as a double session in combination with photocoagulation.

Indications

- Breaks confined to superior 8 clock hours
- Breaks within 1-2 clock hours
- Cooperative patient
- Clear media
- Absence of PVR

Contraindications

- Patients in whom positioning is not possible
- Inferior breaks
- Proliferative vitreoretinopathy of Grade C and above.

Expansile gases	***Non Expansile gases***
SF6 C_2F_6 (perfluoro ethane) C_3F_8 (perfluoro propane)	Air CO_2 Ag. Kr, Helium

Agent	***Dose***	***Expansion***	***Max Exp. (hrs) time***	***Half time (days)***	***Duration in weeks***
SF6	0.5 ml of 100%	x2	24-48 hrs	3-5	2 wks
C_2F_6	0.3 ml of 100%	x3.3	48-72 hrs	10-14	3 wks
C_3F_8	0.3 ml of 100%	x4	72-96 hrs	21-25	>4 wks

After Pneumatic retinopexy proper positioning should be maintained so that the break is uppermost atleast 16 hrs a day. No air travel is allowed as gas will expand. 20-40% of routine primary Rhegmatogenous RD can be managed by this method.

Complications

a. Fish egg formation
b. Subretinal gas migration
c. Accidental damage to lens/retina
d. Haemorrhage may occur if damage to long ciliary arteries occurs
e. Bacterial endophthalmitis

TEMPORARY BALLOON BUCKLING

Inflatable balloon as a temporary buckle to treat RD is a minimally invasive, office based procedure used in uncomplicated breaks or closely clustered breaks. A deflated balloon attached to catheter is inserted through conjunctival incision into the space along the sclera. The balloon is then inflated. It is combined with cryo or laser to create chorioretinal adhesion.

PARSPLANA VITRECTOMY WITH INTERNAL PROCEDURE

Indications

1. RD with PVR grade C or more
2. Giant retinal tears
3. Dialyses
4. Posterior breaks and Macular hole
5. Associated vitreous haemorrhage
6. Combined Rhegmatogenous and tractional detachment

The instruments needed are

1) BIOM or corneal contact lens to aid viewing
2) Vitreous cutter
3) Endoillumination with 20 or 23 gauge fibre optic probe
4) Infusion cannula, Vitreous cutter and back flush flute needle
5) Endolaser
6) Micro vitreoretinal blade
7) Membrane pics and hooked needles
8) Continuous infusion air pump system
9) Vitreous replacement substitute
10) Scleral plugs and forceps

PVR is tackled by peeling, segmentation or delamination. Perflurocarbon liquids are used to flatten the retina. The break is sealed by endolaser. Then fluid air exchange is done. Air can then be exchanged with silicon oil or 14% $C_3 F_8$ or 20% SF_6 to cause internal tamponade.

Vitreous substitutes are used to expand / replace vitreous volume, to exchange opaque vitreous with optically clear material, to tamponade the retina and to separate epiretinal tissue from retina.

Silicone oil	**Perflurocarbon liquid**
• Low specific gravity • Inert, High viscosity • Used for long standing retinal tamponade in PVR and GRT • Can be removed later • **Complications** Emulsification, keratopathy, cataract, Glaucoma, redetachment afer removal	• High specific gravity • Easy to inject and remove • Clear, used temporarily in dialysis, GRT, PVR • Should be removed at the end of surgery • **Complications** Subretinal fluid migration, dispersion into multiple bubble, residual droplet

PROGNOSIS

Anatomical and Visual results after scleral buckling

An overall reattachment rate of at least 80- 90% is achievable. In eyes with successful retinal reattachment of macula-off detachment, approximately 40% to 60% of eyes have final visual acuity of 20/50 or better. The extent and duration of preoperative macular elevation correlates with visual outcome.

75% of patients with macular detachment of less than 1wk duration attain 6/18 or better. Giriad and Karpouzas found that macular detachment of more than seven days has significantly decreased the chance of obtaining 20/50 or better postoperative visual acuity. As the duration of detachment increases beyond 2 weeks cystoids spaces extend throughout the retina. Photoreceptor degeneration is also related to the duration of detachment.

Over the past five decades, the materials and techniques of scleral buckling surgery have undergone continued refinement. Other techniques like pneumatic retinopexy and primary vitrectomy also have been introduced. But still scleral buckling remains the standard.

Failed Surgery

Occurs in 10-12% and the reasons are

(a) Failure to seal the breaks

(b) Failure to produce good chorioretinal adhesion

(c) Retinal redetachment after a initial attachment due to new breaks or slipped buckle

(d) Proliferative Vitreoretinopathy.

OBJECTIVES

1. To evaluate the etiological factors leading to Rhegmatogenous RD
2. To analyse the clinical characteristics for Rhegmatogenous RD
3. To evaluate the outcome after external surgical procedure in terms of anatomical attachment and functional success
4. To assess the prognostic factors leading on to functional success after external scleral buckling surgery

MATERIALS AND METHODS

This study was a prospective interventional study carried out at Retina clinic, Regional Institute of Ophthalmology and Government Ophthalmic Hospital, Chennai during the period Jan 2009 – Oct 2010.

INCLUSION CRITERIA

1. A series of 52 patients with Primary Rhegmatogenous RD reporting to the hospital for the first time during the study period were evaluated.
2. Patients with risk factors like aphakia, pseudophakia, myopia and trauma were included in the study.
3. Rhegmatogenous retinal detachment with breaks anterior to the equator which could be primarily managed with scleral buckling procedure using silicone explants were taken up for this study.
4. Rhegmatogenous RD with PVR upto grade B.

EXCLUSION CRITERIA

1. Patients with associated tractional RD/vitreous haemorrhage
2. Patients with breaks posterior to the equator

3. Rhegmatogenous RD due to macular hole, GRT and Dialyses
4. Rhegmatogenous RD with PVR grade C and D
5. Patients with redetachment
6. Patients operated before the specified period and coming for review
7. Patients who dropped out were excluded from the study
8. Patients who were unwilling to undergo surgery

PROCEDURE

All patients with the above inclusion criteria were taken detailed history like

1. Duration of complaints
2. H/O floaters
3. H/O flashes
4. H/O wearing spectacles for refractive error
5. Previous cataract surgery details and any complication during previous cataract surgery and whether YAG capsulotomy was done and if so their timing after surgery were noted
6. Past history of other intraocular surgery
7. H/O Trauma
8. Family H/O retinal detachment

Visual acuity was measured with Snellen's visual acuity chart. Dilatation and retinoscopy was routinely done and refractive status was assessed. Pupils were dilated with cycloplegic. Anterior segment examination with a slit lamp was done paying attention to corneal, lenticular and vitreous opacities which hinder fundus visualization. In case of Pseudophakic patients any vitreous incarceration in the wound, status of posterior capsule, evidence of the capsulotomy were noted down. Signs of uveitis and pigment dispersion in the vitreous phase were looked for.

By distant direct direct ophthalmoscopy grey reflex was noted. The posterior segment examination using a binocular indirect ophthalmoscope with sclera depression was done in all patients. Three mirror examination was also done. Detailed fundus drawings of both eyes were done in all cases on standard fundus charts using the internationally accepted colour coding.

B Scan USG was done. Axial length was calculated in both eyes with A scan. Systemic examination was done for all patients. Before taking up the patients for planned procedure their blood pressure and blood sugar were brought under control.

Strict bed rest was advised for all patients.

ANAESTHESIA

In cases operated under local anesthesia, facial and peribullar blocks were given with 2% lignocaine supplemented with 0.75% Bupivacaine. General anesthesia was used in paediatric cases. Pupils were dilated with mydriatics and cycloplegics.

SURGICAL PROCEDURE

Fundus diagram was displayed in the operating room. Skin preparation for all patients was done with 5% povidone-iodine.

Conjunctiva and Tenon's capsule were opened 360^0 and relaxing incisions were made. Bridle sutures were applied with reverse mounted needle to all 4 recti taking care to preserve the muscle sheath. Episclera was cleared from sclera with sponge. Localization and confirmation of all the retinal breaks was done by indirect ophthalmoscopy with scleral depression. Areas of tear were marked on sclera using cautery or with gentian violet marker pen.

Four partial thickess scleral tunnels were made after measuring the distance from the limbus if encirclage is planned. Cryopexy according to the standard protocol was done for all retinal breaks and degeneration just long enough for the retina to whiten.

No. 40 Silicon encirclage band was placed underneath the 4 recti muscles and passed underneath the scleral tunnels if encirclage is planned. Radial/segmental circumferential tires were selected according to the size, site and type of retinal breaks. Segmental circumferential /radial plomb was secured with 4-0 ethibond at appropriate sites. The location and elevation of the buckle was checked with the indirect ophthalmoscope. SRF drainage was done in the quadrant where maximum level of fluid was present. In most of the cases drainage was done inferior to horizontal recti. Ends of encirclage band were tied with Watzke sleeve.

The fundus was reexamined to see height of the buckle, adequacy of drainage, and the status of central retinal artery. Intraocular pressure was checked. Sutures were made permanent and conjunctiva was closed with 6-0 vicryl. Subconjunctival antibiotic was injected at the end of surgery.

Postoperatively all patients had pad and bandage for one day. Topical antibiotic steroid drops were prescribed. Systemic antibiotics and antiinflammatory drugs were given for a week. Postoperatively detailed anterior segment examination was done noting down any evidence of corneal edema, evidence of uveitis and pupillary reaction.

FOLLOW UP

Every patient was asked for a regular follow up every 1 week for 1 month for three visits, every month for three visits. At each visit the status of the anterior segment, fundus and visual acuity was checked and recorded in all the patients. The other eye was also considered high risk and periodically examined under full dilatation. Prophylatic therapy was given in other eye if needed during the postoperative stay and follow up.

OBSERVATION AND INTERPRETATION

52 patients presented to our institute with Primary Rhegmatogenous RD in Phakic, Pseudophakic & Aphakic eyes were enrolled into this study.

AGE DISTRIBUTION

Age in Years	No. of Cases	Percentage
1-10	0	0.00
11-20	3	5.77
21-30	4	7.69
31-40	4	7.69
41-50	10	19.23
51-60	17	32.69
61-70	11	21.15
71-80	2	3.85
81 & Above	1	1.92
Total	**52**	**100**

The highest incidence was seen in 51-60 years age group. The youngest patient was 14years old and the oldest patient was 85years old. Phakic eyes due to age related PVD without any risk factors had RD at a later age compared to postoperative cases.

SEX DISTRIBUTION

Sex Distribution	No. of Cases	Percentage
Male	34	65.38
Female	18	34.62
Total	**52**	**100**

Male patients predominated in the study. Male: female sex ratio was around 1.89:1. Both the longer axial length in males and differences in basal vitreoretinal adhesion may contribute to the higher incidence of rhegmatogenous RD in males. Increased incidence of trauma and social factors are also responsible for this male predominance.

LATERALITY

Laterality	No. of Cases	Percentage
RE	30	57.69
LE	22	42.31
Total	**52**	**100**

Right eye was more commonly involved compared to left eye. Four patients had long standing RD in the fellow eye out of which fellow eye of one patient was already operated.

TYPE OF EYE

Type of Eye	No. of Cases	Percentage
Phakic	29	55.77
Pseudophakic	20	38.46
Aphakic	3	5.77
Total	**52**	**100**

29 cases (55.77%) of RD belong to Phakic group. Only 3 out of 52 patients were aphakics and 20 cases (38.46%) of RD were pseudophakics. This increased incidence in pseudophakic eyes is due to that they recognize symptoms early and also because of change in the trend and increase in the number of cataract surgeries being performed.

DURATION AFTER YAG CAPSULOTOMY

Type of Eye	No. of Cases
<3 months	0
3-6 months	2
>6 months	1

Out of 3 patients who underwent YAG Capsulotomy 2 patients have developed RD within 6 months.

PATTERN OF DETACHMENT

Detachment Pattern	No. of Cases	Percentage
1 quadrant	4	7.69
2 quadrants	13	25.00
3 quadrants	15	28.85
4 quadrants	20	38.46
Total	**52**	**100**

Total detachment was seen in 20 cases (38.46%) and subtotal detachment in 15 cases (28.85%). Both together contribute to total incidence of 35 cases (67.31%) since most of the patients reported late.

STATUS OF MACULA

Status of Macula	No. of Cases	Percentage
Off	44	84.62
On	8	15.38
Total	**52**	**100**

Only 8 cases (15.38%) presented with macula on status. Patients who presented late with macula off status had poor functional outcome.

NUMBER OF RETINAL BREAKS

Number of Retinal breaks	No. of Cases	Percentage
Single	34	65.38
Multiple	13	25.00
No Breaks	5	9.62
Total	**52**	**100**

Single break was seen in 34 cases (65.38%). No breaks could be made out in 5 cases (9.62%) probably due to anterior location of the break and poor dilation of the pupil in pseudophakic and aphakic eyes.

TYPE OF BREAK

Type of Break	No. of Cases	Percentage
Round Hole	17	29.82
Horse shoe tear	22	38.60
Operculated tear	5	8.77
Irregular tear	8	14.03
No Breaks	5	8.77

Horse shoe tears were the commonest (22 out of total 57 breaks) followed by round holes (17 out of 57 breaks).

QUADRANT LOCATION OF BREAKS

Quadrant Location	No. of Cases	Percentage
Superotemporal	23	44.23
Inferotemporal	13	25.00
Superonasal	9	17.31
Inferonasal	5	9.62
No Breaks	5	9.62

Highest incidence of breaks was seen in ST quadrant for 23 cases (44.23%) in our study followed by IT quadrant in 13 cases (25%).

RISK FACTORS

Risk factors	No. of Cases	Percentage
Myopia	15	28.84
PC rent	8	15.38
Trauma	6	11.54
Other eye RD	4	7.69
YAG Capsulotomy	3	5.77

Among 52 cases 15(28.84%) patients had myopia of which 6 of them had high myopia. Next in frequency was Posterior capsular rupture (8 cases / 15.38%) followed by Trauma (6 cases / 11.54%). YAG capsulotomy was present in 3(5.77%) cases.

PREOPERATIVE VISUAL ACUITY

Preoperative BCVA	No. of Cases	Percentage
PL,CFCF,HM,1/2/60	29	55.77
1/60-5/60	15	28.85
6/60-6/24	2	3.85
6/18-6/6	6	11.54
Total	**52**	**100**

Preoperatively 29 cases (55.77%) presented with BCVA <1/60.

TIME OF PRESENTATION

Time of Presentation	No. of Cases	Percentage
≤ 1week	8	15.38
> 1week – 1month	25	48.08
> 1month – 2months	10	19.23
> 2month – 4months	6	11.54
> 4month – 6months	3	5.77
Total	**52**	**100**

Out of 52 patients only 8 presented to our institute within 1week. 25 patients had defective vision of 1 month duration. 9 patients presented only after 2 months.

SURGICAL PROCEDURE

Surgical Procedure	No. of Cases	Percentage
Encirclage+Segmental+Cryo	30	57.69
Encirclage+Radial+Cryo	9	17.31
Encirclage+Cryo	10	19.23
Radial/Segmental+Cryo	3	5.77
SRF drainage	31	59.61

Encirclage was done in 49 cases (94.23%) along with Radial or Circumferential segmental buckle according to the extent and location of the break. Cryopexy was done in all 52 patients. 31 cases (59.61%) needed SRF drainage.

ANATOMICAL ATTACHMENT

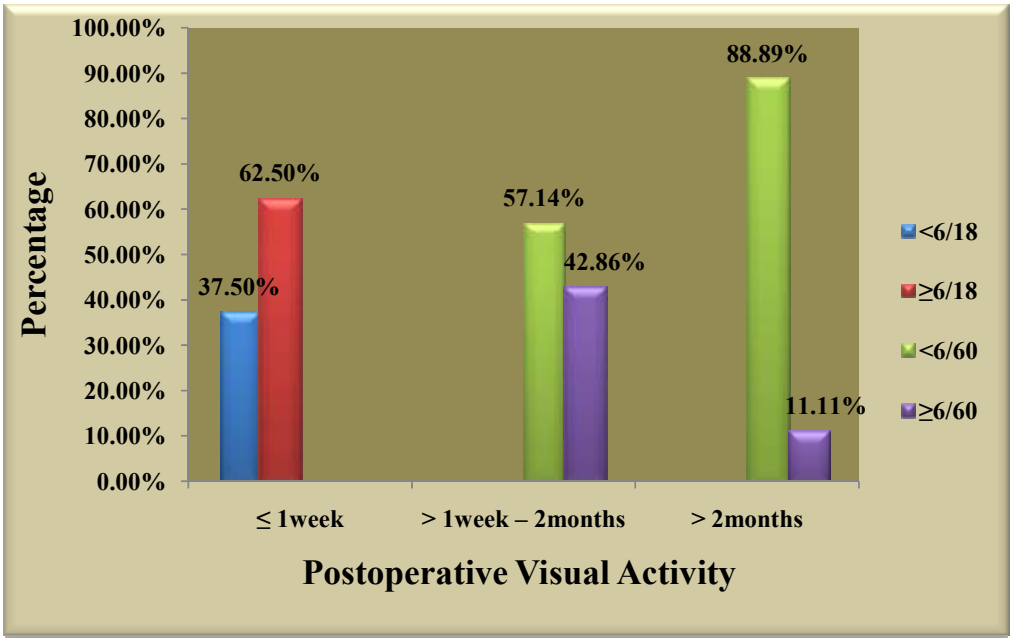
Anatomical Attachment	**No. of Cases**	**Percentage**
Attached	43	82.69
Persistent detachment	9	17.39
Total	**52**	**100**

43 cases (82.69%) had successful anatomical repositioning after surgery.

POSTOPERATIVE VISUAL ACTIVITY

Duration	No. of Cases			
	≥6/18	<6/18	≥6/60	<6/60
≤ 1week	5	3		
1week – 2months			15	20
> 2months			1	8

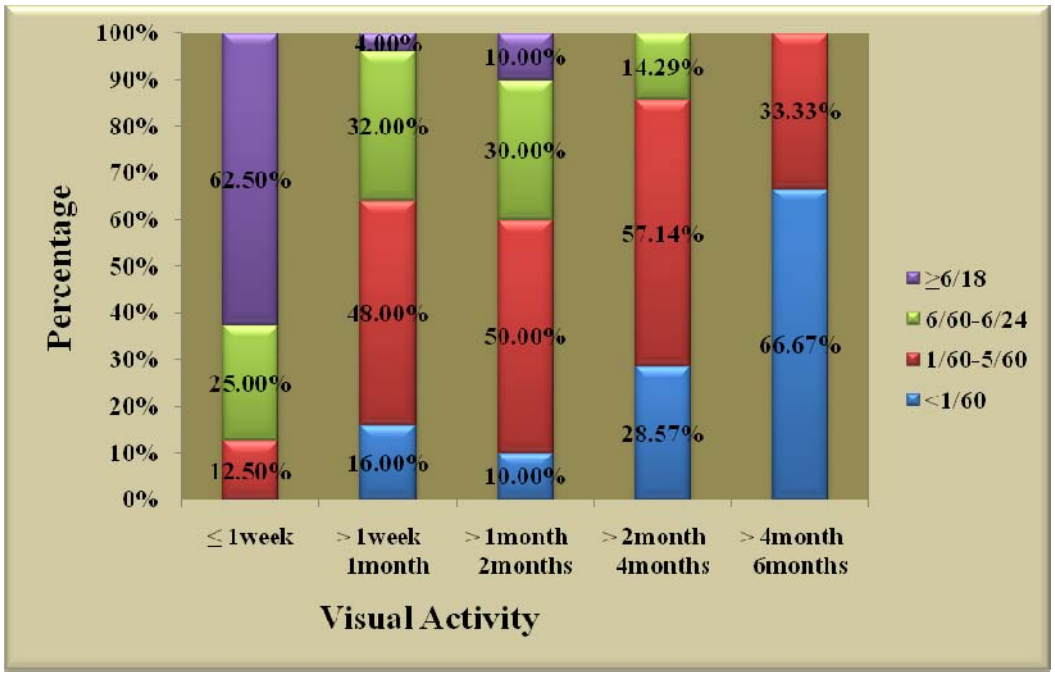
5 out of 8 cases(62.5%) regained ≥ 6/18 BCVA among those who presented within 1 week. 15 cases(42.86%) who presented between 1 week to 2 months had postoperative BCVA of ≥ 6/60 . Only 1 out of 9 cases (11.11%) who presented late to our institute had BCVA >6/60.



Visual outcome according to duration at presentation

Duration	No. of Cases			
	<1/60	1/60-5/60	6/60-6/24	≥6/18
≤ 1week	0	1	2	5
> 1week – 1month	4	12	8	1
> 1month – 2months	1	5	3	1
> 2months – 4months	2	4	1	0
> 4months – 6months	2	1	0	0

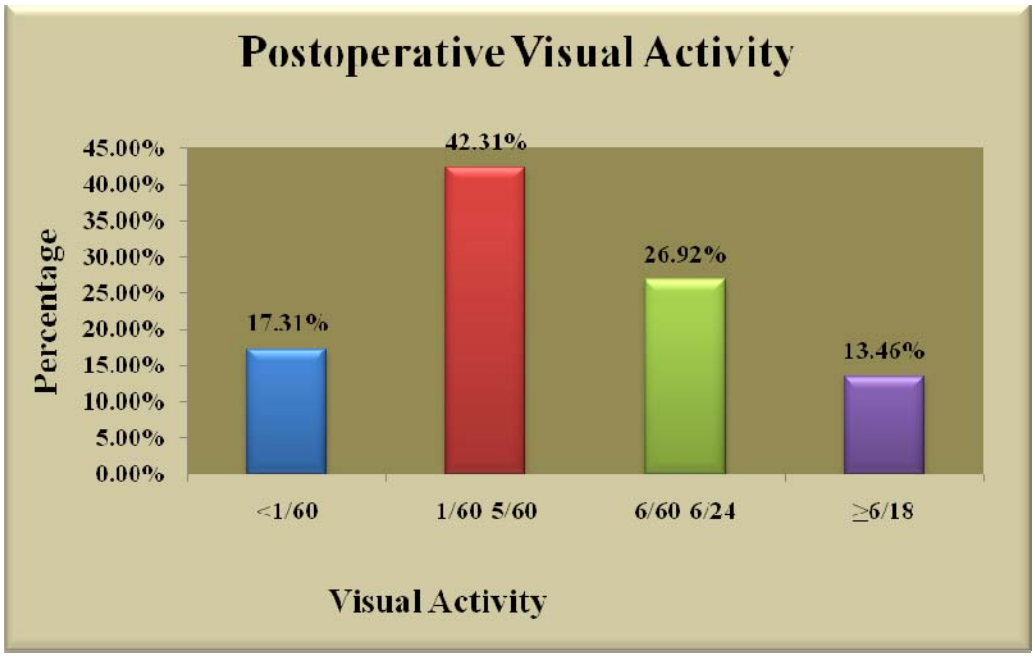
5(62.5%) out of 8 patients presented within 1 week had BCVA ≥ 6/18. But 4(57.14%) out of 7 patients who presented between 2-4 months had BCVA in the range of 1/60 – 5/60.



POSTOPERATIVE VISUAL ACUITY

Postoperative Visual Acuity	No. of Cases	Percentage
<1/60	9	17.31
1/60-5/60	22	42.31
6/60-6/24	14	26.92
≥6/18	7	13.46
Total	**52**	**100**

Most of the patients had BCVA in the range of 1/60 – 5/60. Only 14 patients (26.92%) recovered ≥ 6/60 vision. Detached macula on initial examination and late reporting along with extent and elevation of retinal detachment account for the poor functional outcome.



PREOPERATIVE AND POSTOPERATIVE V/A COMPARISON

Visual Acuity	Preop No. of Cases	Postop No. of Cases
<1/60	29	9
1/60-5/60	15	22
6/60-6/24	2	14
6/18-6/6	6	7
Total	**52**	**52**

Preoperatively 29 (55.77%) out of 52 patients had BCVA<1/60. Postoperatively most of the patients (22 patients/42.31%) had improved to BCVA in the range of 1/60-5/60. Only 9 patients had BCVA <1/60.

POSTOPERATIVE COMPLICATIONS

Complications	No. of cases	Percentage
Proliferative vitreretinoopathy	4	7.69
Plomb exposure	2	3.84
Muscle imbalance	2	3.84
Tenon's cyst	1	1.92

4 patients who had persistent RD developed PVR during follow up. 2 of our patients developed plomb exposure which was subsequently removed. One patient developed tenon's cyst and it was excised.

DISCUSSION

The term retinal detachment is used to describe separation of neurosensory retina from retinal pigment epithelium. When the normal physiological forces that maintain the apposition between the RPE and neurosensory retina are overwhelmed retinal detachment occurs.

In our case series of 52 patients who presented with primary RRD with duration of less than 6 months increased incidence was observed in 51 to 60 years age group. Phakic eyes had increased incidence between 50 to 70 years whereas pseudophakics had more incidence between 48 to 60 years. Age related aggregation of collagen framework and liquefaction of the vitreous is responsible for PVD which subsequently led onto RD in this age group. Intraocular surgery accelerates the occurrence of PVD that correlates with earlier onset of RD in pseudophakics in our study group.This correlates with the mean age (53.9 years) in the study conducted by PolkinghornePJ et al (Clin and Experimental Ophthalmol. 2004 Apr; 32 (2):159-63).

Male: Female sex ratio was around 1.89: 1 in our study group. Both the longer axial length in males and posterior migration of the posterior border of the vitreous base in males may contribute to the higher incidence of RRD in males as connoted by DannyMitry et al. (Graefe's archive for clinical and exp. ophthalmology, sept.2010)

Phakic eyes (29 cases (55.77%)) had higher incidence whereas 20 cases (38.46%) of RD were Pseudophakics. This relatively higher proportion of pseudophakic eyes in our study is due to the fact they recognize symptoms early and also because of change in the type and increase in the number of cataract surgeries being performed.

A number of conditions exist that predispose to a PVD by prematurely accelerating the liquefaction of the vitreous gel. Among the total 52 patients myopes contribute to 28.84% of RD. Next in frequency was PC rent found in 8 cases (15.38%). H/o trauma was present in 6 cases (11.54%). 4 patients had detachment in the fellow eye also. Out of those 3 who underwent YAG capsulotomy two patients developed RD within 6 months after the procedure. In a study Glacet-Bernard A et al observed that the average duration between YAG capsulotomy and RRD is 3.6 months (J Fr Ophthalmol. 1993; 16(2):87-94.)

Most of them (35 cases (67.31%)) presented with total detachment and subtotal detachment. Forty four (84.62%) patients had macula off status since most of the patients reported late. Macular on/off status along with extent end elevation of RD predicted the functional outcome after successful external buckling procedure.

Horse shoe tears due to vitreoretinal traction were the commonest (22 out of total 57 breaks) followed by round holes (17 out of 57 breaks). Lattice degeneration with atrophic holes was observed in young myopic eyes.

Highest incidence of breaks was seen in superotemporal quadrant for 23 cases (44.23%) in our study followed by inferotemporal quadrant in 13 cases (25%). This is in accordance with the results of study conducted by Rosman M et al (Inter ophthal, Volume 24, Number 2, 2001, Page no.101-106(6)). Due to the effect of gravitational force exerted by the vitreous upon retina superotemporal quadrant is more commonly involved. Single break was seen in 34 cases (65.38%) whereas no breaks could be made out in 5 cases (9.62%) probably due to anterior location of the break and poor dilation of the pupil in pseudophakic and aphakic eyes.

Preoperatively 29 cases (55.77%) presented with BCVA <1/60. Majority of them had detachment of 1 month duration. Only 8 patients reported within 1 week with most of them having macula on detachments. 9 patients presented only after 2 months.

We performed encirclage in 49 cases (94.23%) along with Radial or Segmental circumferential buckle according to the extent and location of the break. Aseptic chorioretinal adhesion was achieved by cryo in all 52 patients. SRF drainage was needed in 31 cases (59.61%) .

We achieved successful anatomical attachment in 43 cases (82.69%). This is in concordance with the anatomical success rate after buckling procedure by Ulrich Thelen et al (Ophthalmology Volume 117, Issue 4, Pages 785-790 (April 2010)). Failure was due to missed breaks and failure to seal the break.

Postoperatively 5 out of 8 cases (62.5%) had BCVA ≥ 6/18 among those who presented within 1 week. 15 out of 35cases(42.86%) who presented between 1 week to 2 months had postoperative BCVA of ≥ 6/60 . Only 1 out of 9 cases (11.11%) who had detachment for more than 2 months had BCVA >6/60.

Overall functional success rate was not significant in our case series. Majority of the patients had BCVA in the range of 1/60 – 5/60. Only 14 patients (26.92%) recovered ≥ 6/60 vision. Detached macula on initial examination and late reporting along with extent and elevation of retinal detachment account for the poor functional outcome.

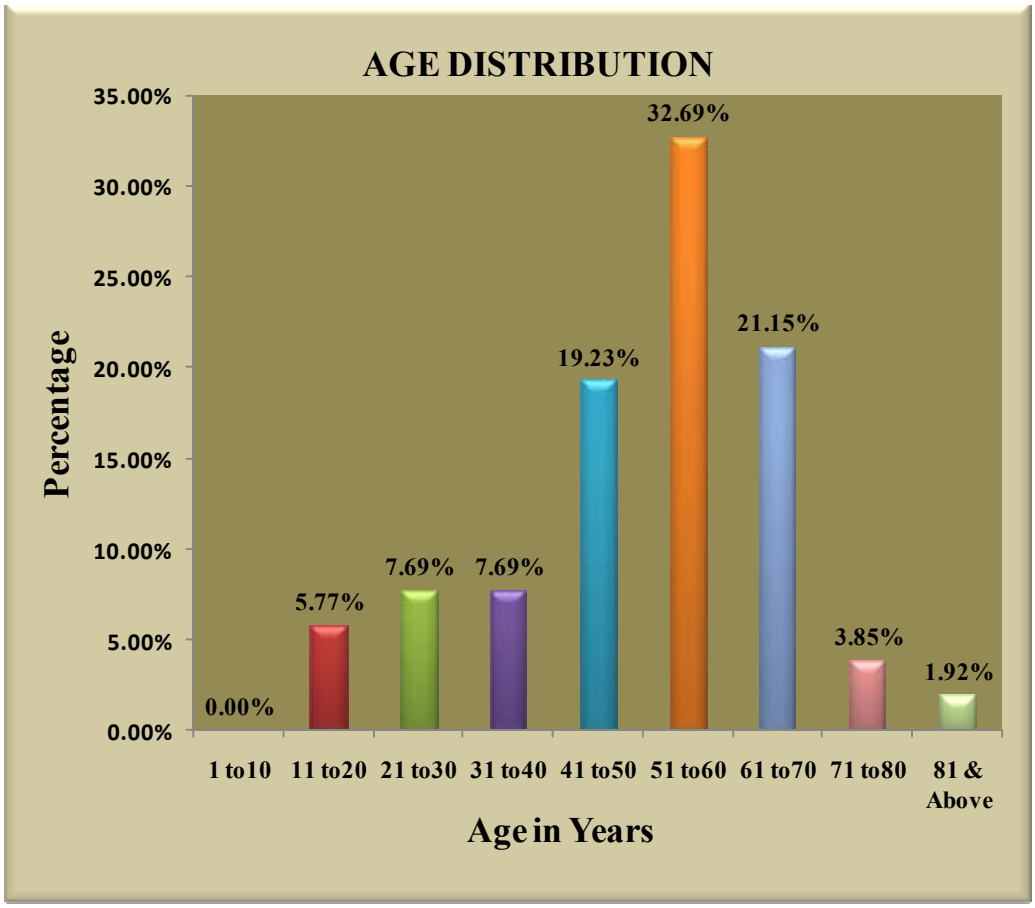
We performed barrage laser for those who had peripheral lattice degeneration in the fellow eye. 4 patients who had persistent RD after surgery developed PVR later during follow up. 2 patients had plomb exposure which was subsequently removed. One patient developed Tenon's cyst and it was excised.

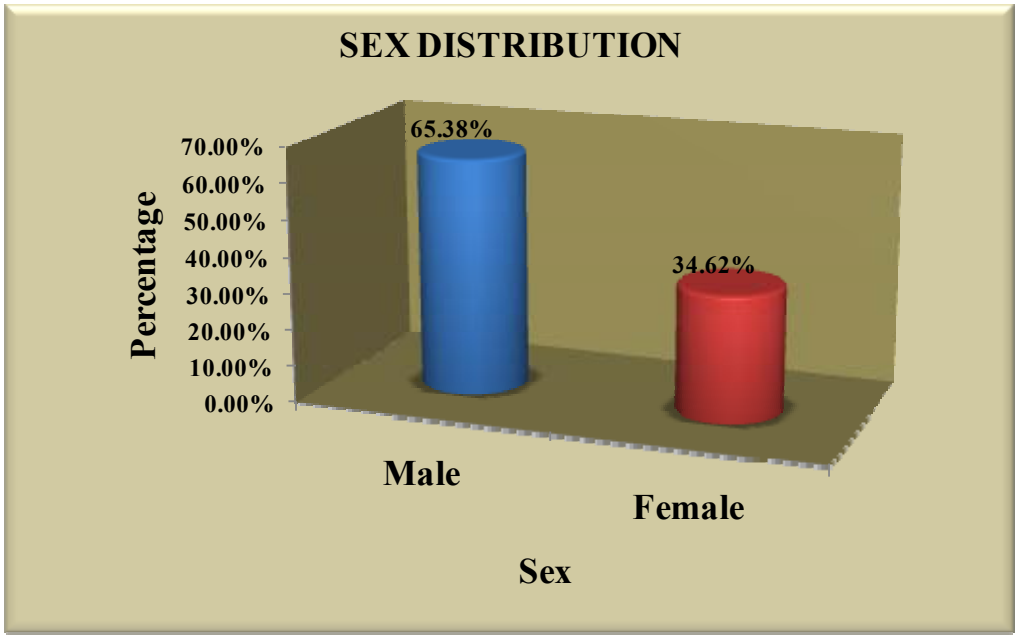
CONCLUSION AND RECOMMENDATION

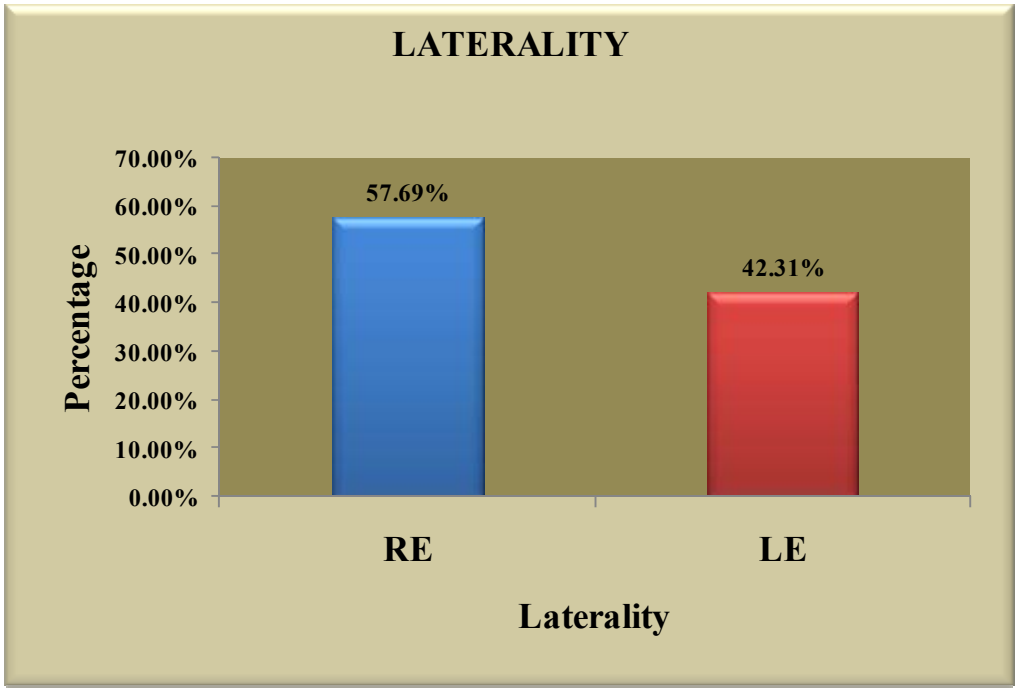
This study confirms that the incidence of RRD was found to increase with age and in association with myopia, cataract surgery, fellow eye RD, familial predisposition, YAG capsulotomy and trauma. Hence the fellow eye should be properly examined to rule out any predisposing peripheral degeneration and should be given prophylactic therapy. Early identification of PCR during surgery with proper anterior vitrectomy and cleanup of vitreous from wound is essential to prevent vitreous traction and subsequent development of RRD.

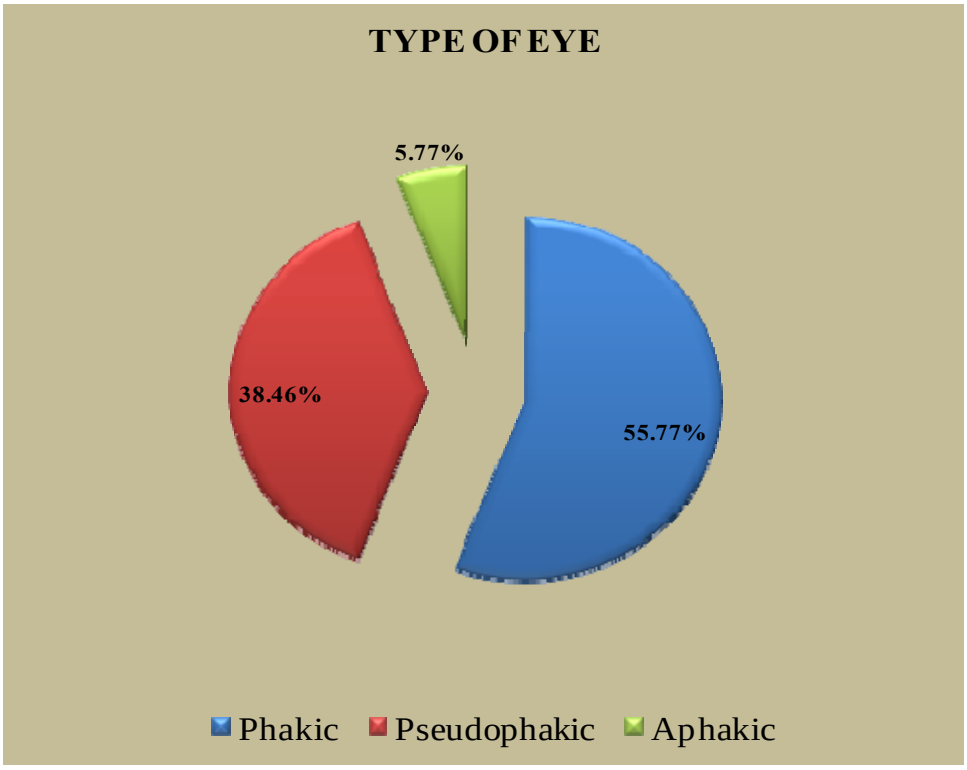
This study clearly indicates that anatomical attachment after external buckling procedure does not correlate with functional success. Duration of macular detachment and extent and elevation of detachment are the main predictors for the functional recovery. Hence patient education regarding early symptoms, periodic detailed fundus examination especially in myopes and in postoperative patients who has increased risk in the first year after surgery should be emphasized. In those cases prompt early management may improve the visual outcome.

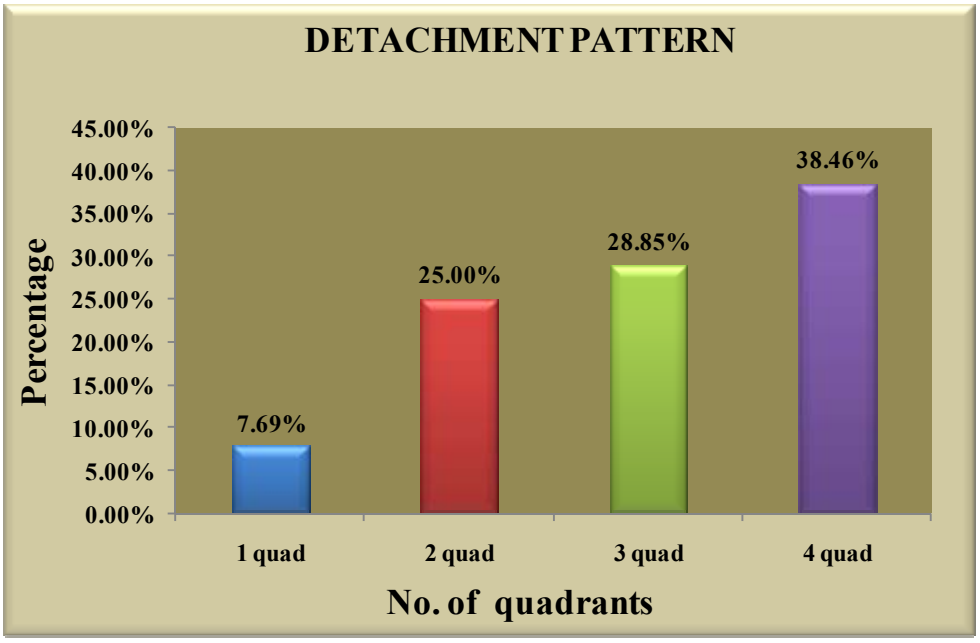
PART II

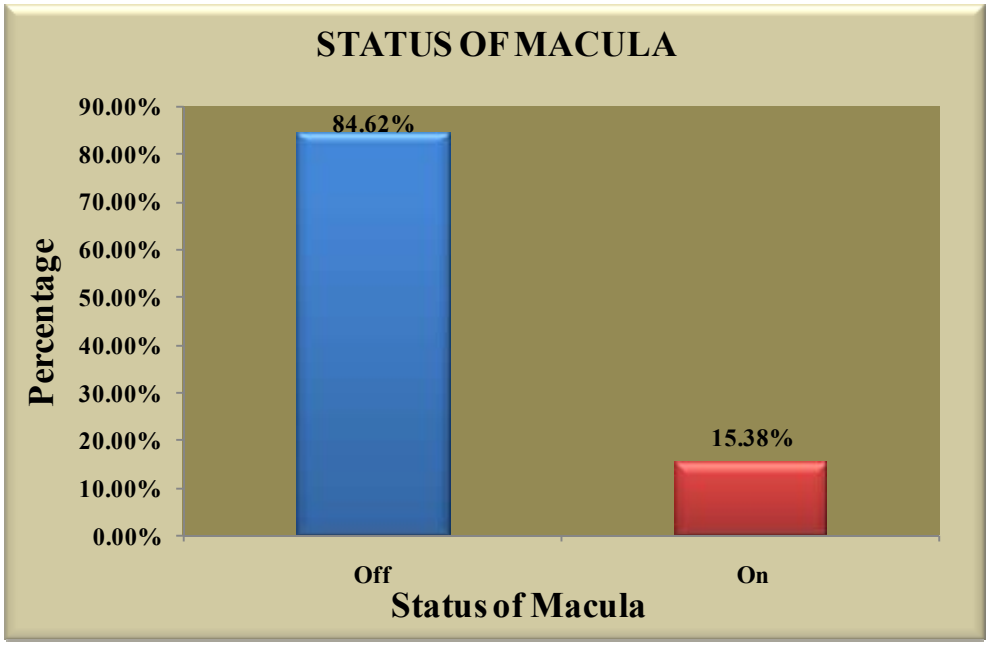

AGE DISTRIBUTION
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
Percentage
0.00%
5.77%
7.69%
7.69%
19.23%
32.69%
21.15%
3.85%
1.92%
1 to10
11 to20
21 to30
31 to40
41 to50
51 to60
61 to70
71 to80
81 & Above
Age in Years

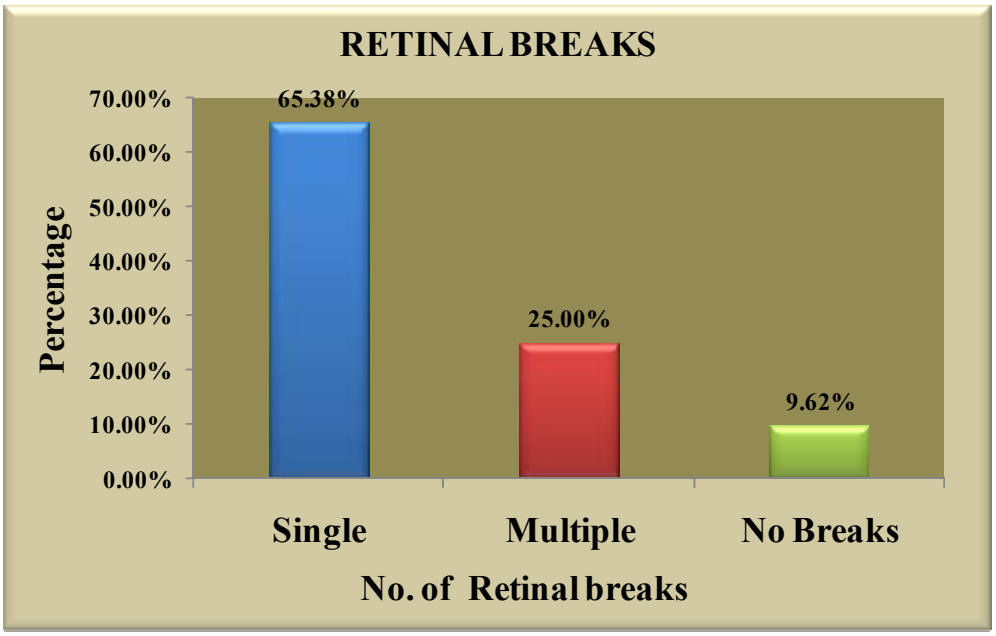

SEX DISTRIBUTION
Percentage
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
65.38%
34.62%
Male
Female
Sex

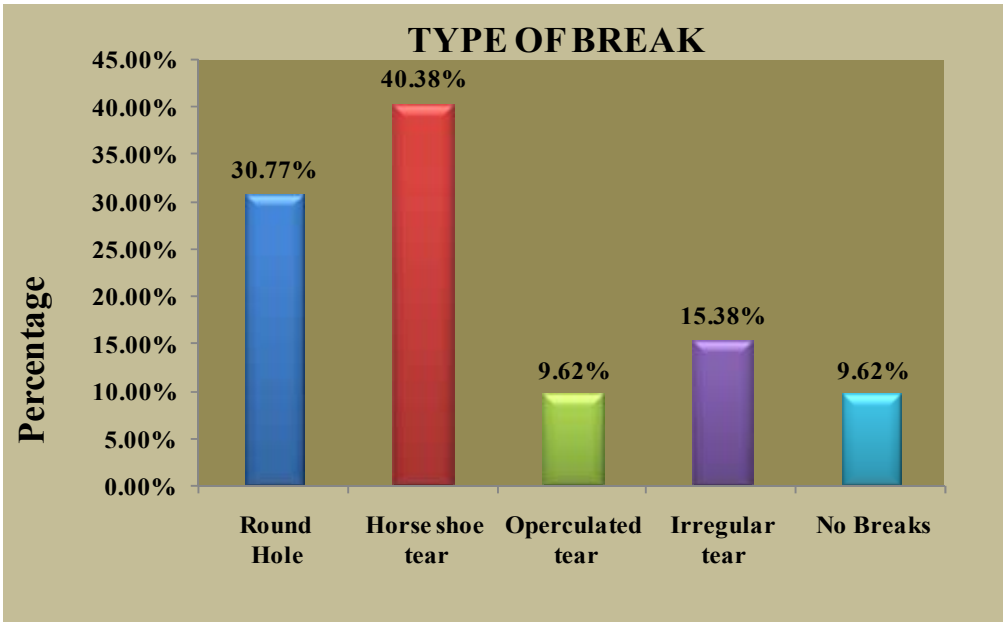

LATERALITY
Percentage
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
57.69%
42.31%
RE
LE
Laterality

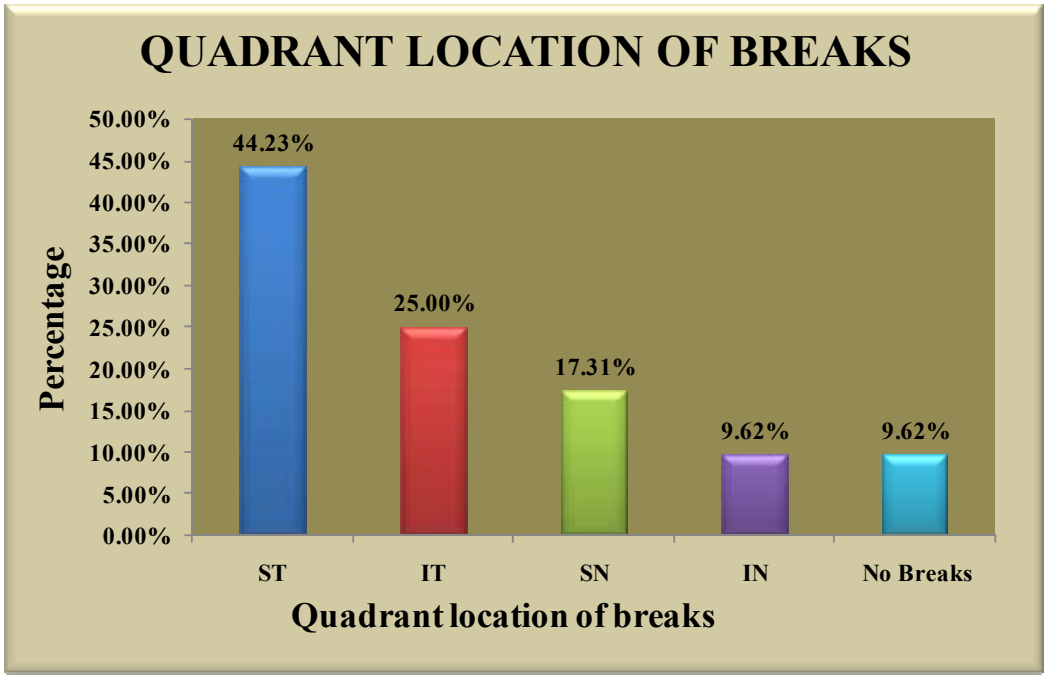

TYPE OF EYE
5.77%
38.46%
55.77%
Phakic
Pseudophakic
Aphakic

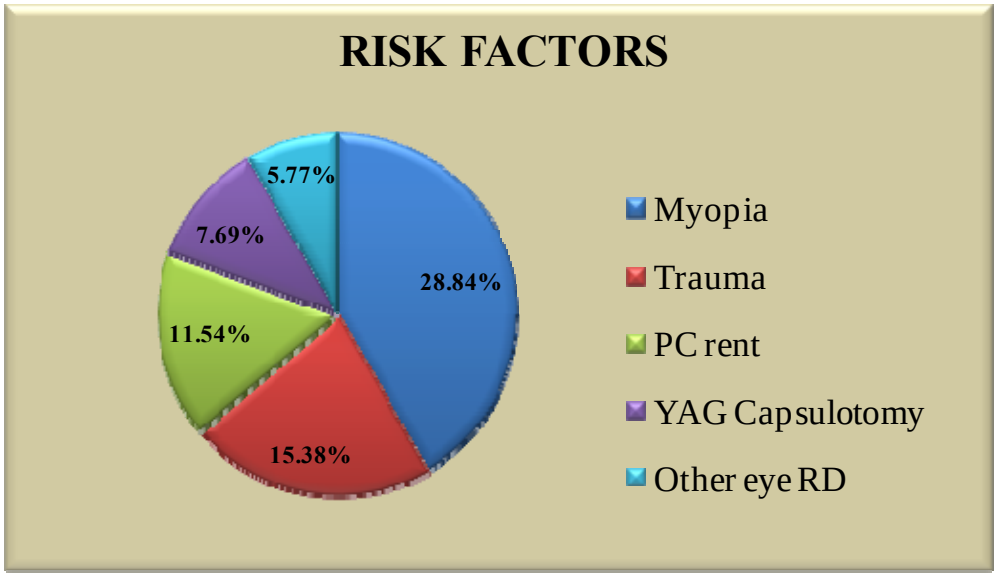

DETACHMENT PATTERN
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
Percentage
7.69%
25.00%
28.85%
38.46%
1 quad
2 quad
3 quad
4 quad
No. of quadrants

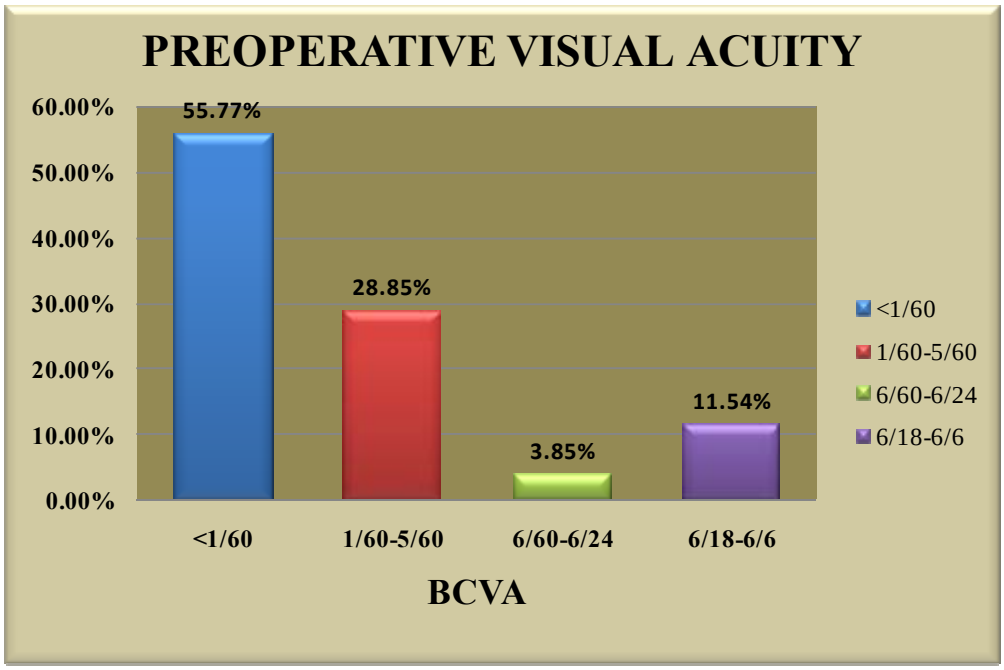

STATUS OF MACULA
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Percentage
84.62%
15.38%
Off
On
Status of Macula

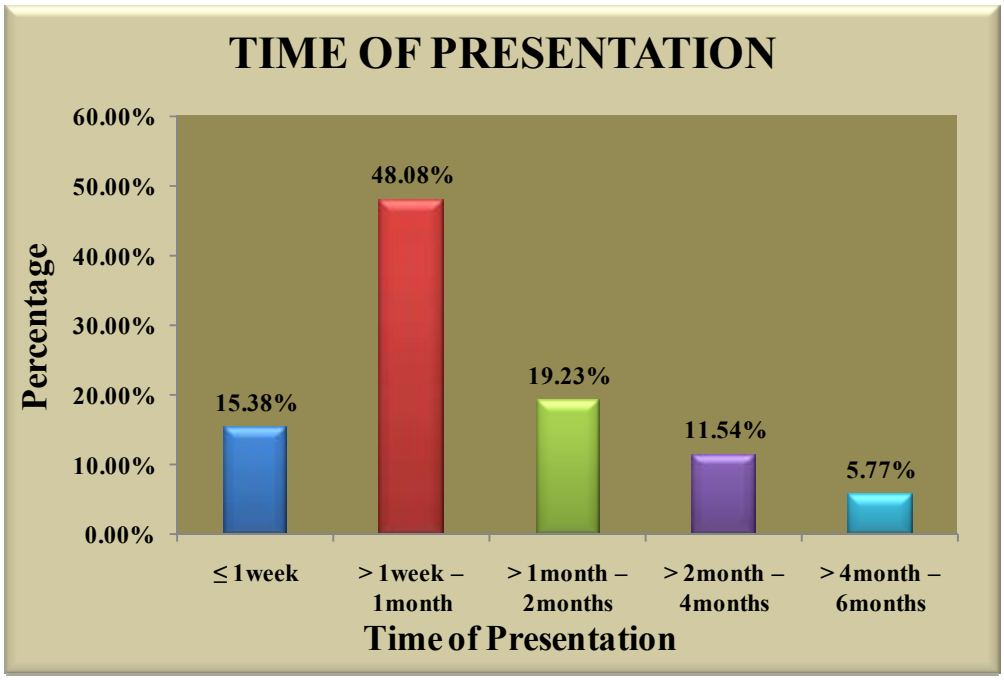

RETINAL BREAKS
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Percentage
65.38%
25.00%
9.62%
Single
Multiple
No Breaks
No. of Retinal breaks

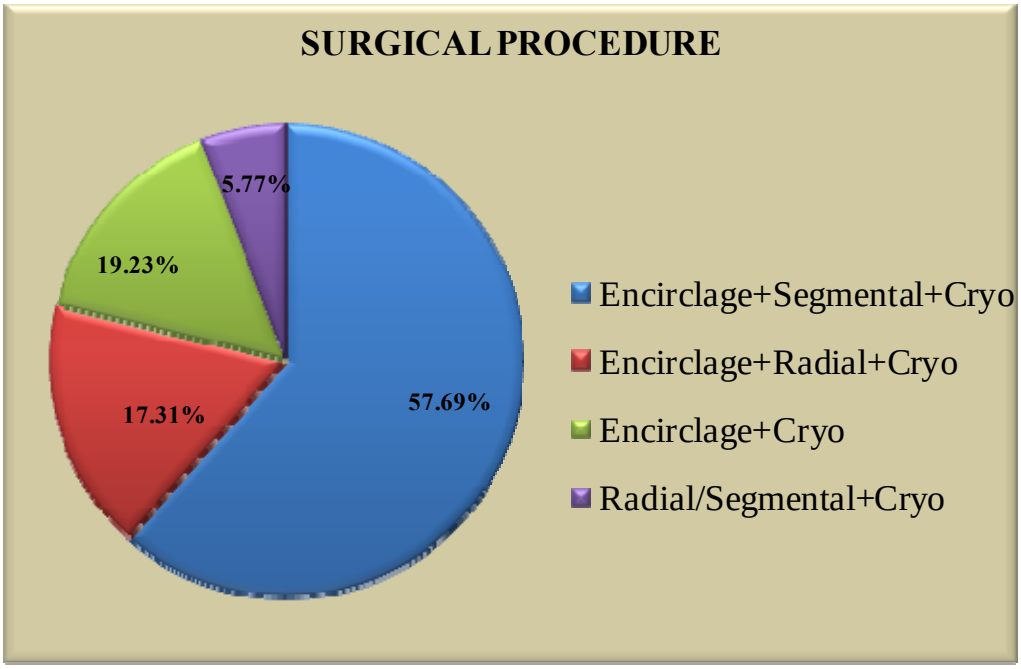

TYPE OF BREAK
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
Percentage
30.77%
40.38%
9.62%
15.38%
9.62%
Round Hole
Horse shoe tear
Operculated tear
Irregular tear
No Breaks

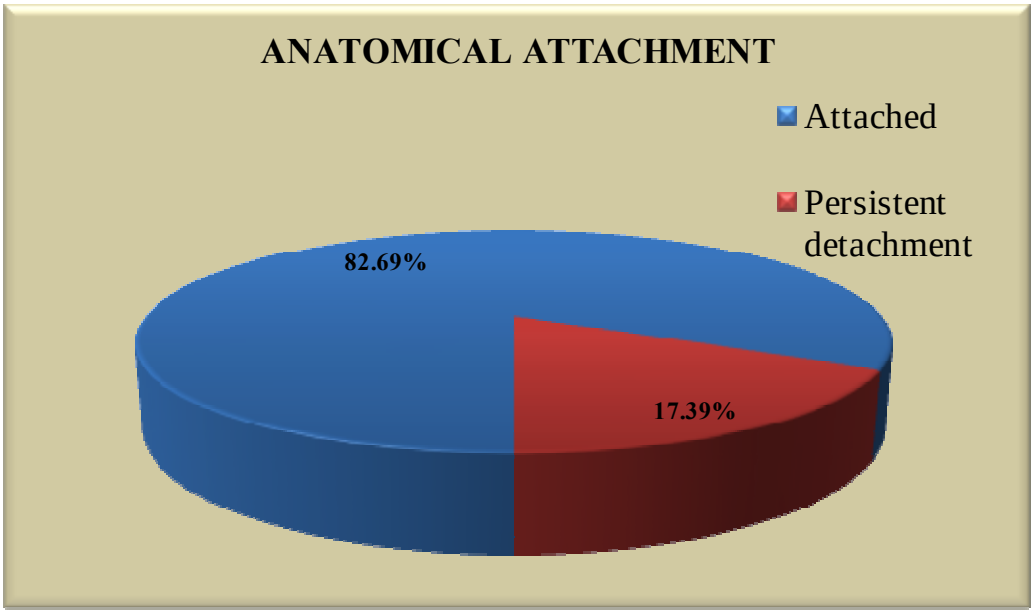

QUADRANT LOCATION OF BREAKS
50.00%
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
Percentage
44.23%
25.00%
17.31%
9.62%
9.62%
ST
IT
SN
IN
No Breaks
Quadrant location of breaks

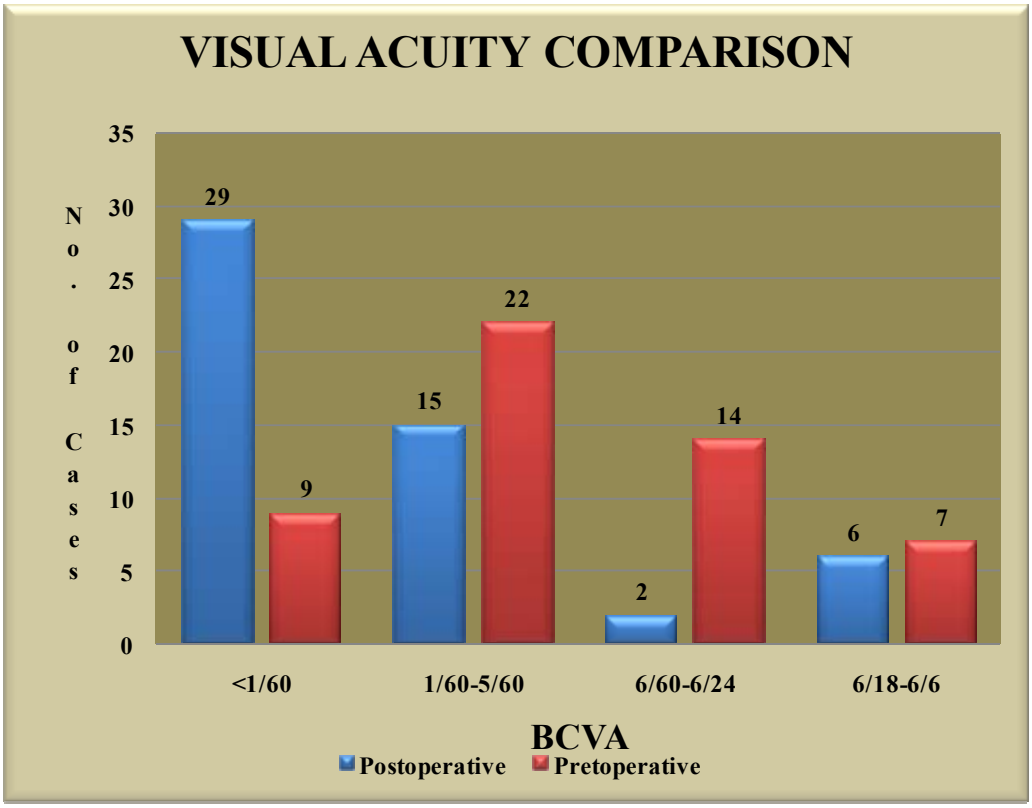

RISK FACTORS
5.77%
7.69%
28.84%
11.54%
15.38%
Myopia
Trauma
PC rent
YAG Capsulotomy
Other eye RD

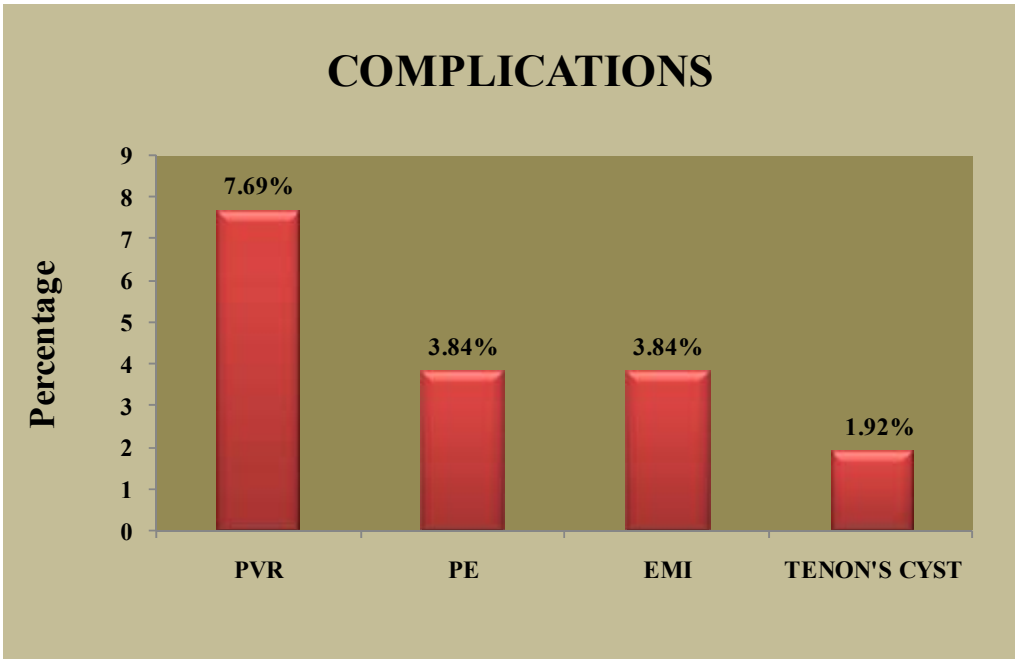

PREOPERATIVE VISUAL ACUITY
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
55.77%
28.85%
3.85%
11.54%
<1/60
1/60-5/60
6/60-6/24
6/18-6/6
BCVA


TIME OF PRESENTATION
Percentage
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
15.38%
48.08%
19.23%
11.54%
5.77%
≤ 1week
> 1week – 1month
> 1month – 2months
> 2month – 4months
> 4month – 6months
Time of Presentation


SURGICAL PROCEDURE
5.77%
19.23%
17.31%
57.69%
Encirclage+Segmental+Cryo
Encirclage+Radial+Cryo
Encirclage+Cryo
Radial/Segmental+Cryo


ANATOMICAL ATTACHMENT
Attached
Persistent detachment
82.69%
17.39%


VISUAL ACUITY COMPARISON
No. of Cases
35
30
25
20
15
10
5
0
29
9
15
22
2
14
6
7
<1/60
1/60-5/60
6/60-6/24
6/18-6/6
BCVA
Postoperative
Pretoperative


COMPLICATIONS
Percentage
9
8
7
6
5
4
3
2
1
0
7.69%
3.84%
3.84%
1.92%
PVR
PE
EMI
TENON'S CYST

PART III

AN ANALYTICAL STUDY OF

RHEGMATOGENOUS RETINAL DETACHMENT

Proforma case sheet

Name - **Age -** **Sex -** **IP No –**

Occupation - **DOA -** **DOD -**

Case no -

Presenting complaints-

Duration	**RE / LE**
Flashes	Yes/No
Floaters	Yes/No
Defective vision	
Others including field defect	

Past history-

H/o trauma-

H/o wearing glasses in the past- myopia/hypermetropia

H/o cataract surgery –

Any Intraoperative complication - PC rent/anterior vitrectomy

Post op visual recovery-Immediate/prolonged

H/o YAG Capsulotomy - If yes-when

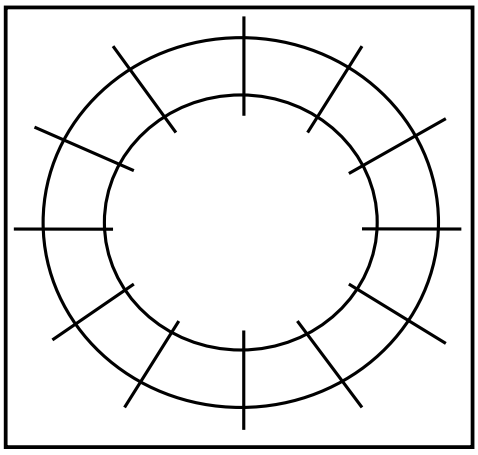
H/o systemic disease-

Family History- H/o any ocular pathology including RD & systemic disease.

General Examination-

Ocular Examination	RE	LE
Eye position		
EOM		
Anterior segment		
Pupil		
Lens including IOL		
Status of posterior capsule, any opacification		
Fundus including any media opacity		

Fundus diagram



Description of Retinal detachment-

1. Extent of detachment
2. Macula status
3. Contour

4. Retinal breaks
   a) Visualized or not
   b) Type
   c) Location
5. Peripheral degeneration
6. Fellow eye

Investigation-

1. Visual activity RE LE

   Distance

   Near

   Retinoscopy

   Corrected V/A

2. Tension
3. Fields
4. Ultrasound

Treatment-

Post op-

Visual acuity

Anatomical attachment

Follow up -

KEY TO MASTER CHART

M	-	Male
F	-	Female
RE	-	Right eye
LE	-	Left eye
Ph	-	Phakia
Ps	-	Pseudophakia
A	-	Aphakia
PCR	-	Posterior capsular rent
Tr	-	Trauma
Ref.status	-	Refractive status
YAG	-	Yittrium Aluminium Garnet
Dur.	-	Duration
Pre op	-	Preoperative
S	-	Single
M	-	Multiple breaks
HST	-	Horse shoe tear
RH	-	Round hole
OT	-	Operculated tear
Irr. LT	-	Irregular Linear tear
Loc.	-	Location
Ma	-	Macula

Quad	-	Quadrant
ST	-	Superotemporal
SN	-	Superonasal
IT	-	Inferotemporal
IN	-	Inferonasal
BCVA	-	Best Corrected Visual Acuity
HM	-	Hand movement
CFCF	-	Counting fingers close to face
Att	-	Attachment
A	-	Attached
NA	-	Not attached
E	-	Encirclage
SC	-	Segmental circumferential
C	-	Cryotherapy
R	-	Radial Plomb
SRFD	-	SRF drainage
PPV	-	Parsplana vitrectomy
RD	-	Retinal detachment
PVR	-	Proliferative vitreoretinopathy
PE	-	Plomb Extrusion
EMI	-	Extraocular muscle imbalance

ABBREVIATIONS

S/L	-	Slit lamp
SRF	-	Subretinal fluid
CR	-	Chorioretinal
CRA	-	Central retinal artery
MPS	-	Mucopolysaccharidoses
VR	-	Vitreoretinal
RPE	-	Retinal pigment Epithelium
WWP	-	White without Pressure
AP	-	Anteroposterior
YAG	-	Yittrium Aluminium Garnet
PCO	-	Posterior Capsular Opacification
NFL	-	Nerve Fibre layer
PRD	-	Pseudophakic Retinal Detachment
PVD	-	Posterior Vitreous detachment
RD	-	Retinal detachment
IOL	-	Intra Ocular lens
IOP	-	Intra Ocular pressure
PVR	-	Proliferative Vitreoretinopathy
PDR	-	Proliferative Diabetic Retinopathy
ROP	-	Retinopathy of Prematurity
PHPV	-	Persistent Hyperplastic Primary Vitreous

IDO	-	Indirect Opthalmoscopy
ERG	-	Electroretinogram
GRT	-	Giant Retinal tear
DACE	-	Drainage + Air + Cryo + External Buckling
CRAO	-	Central Retinal Artery occlusion
CRA	-	Central Retinal Artery
SF_6	-	Sulphur Hexaflouride
C_2F_6	-	Perflouroethane
C_3F_8	-	Perflouropropane
BIOM	-	Binocular Indirect Ophthalmo Microscopy

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10. Ophthalmology – Myron Yanoff & Jay s Duker

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14. Retrospective study of retinal detachment following neodymium: YAG laser posterior capsulotomy. J Cataract Refract Surg (Dardenne MU, Gerten GJ, Kokkas K, Kermani O 1989; 15:676-80)

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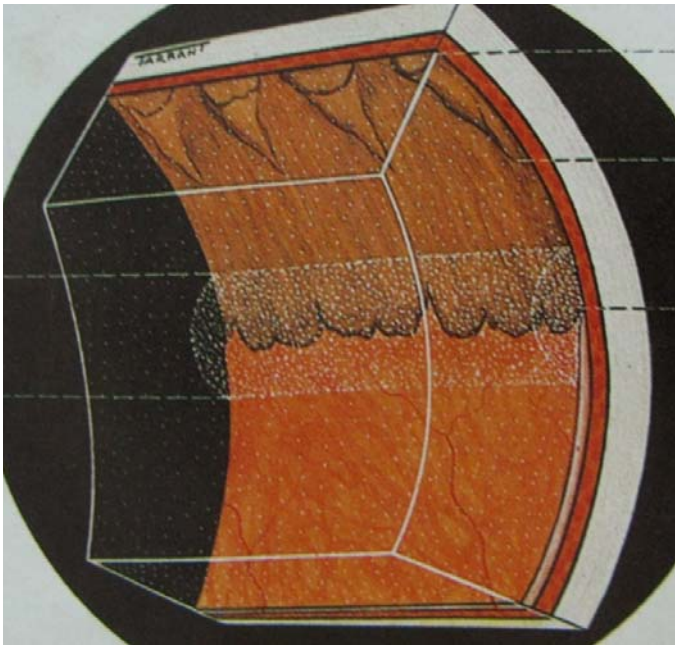
LIST OF SURGERIES

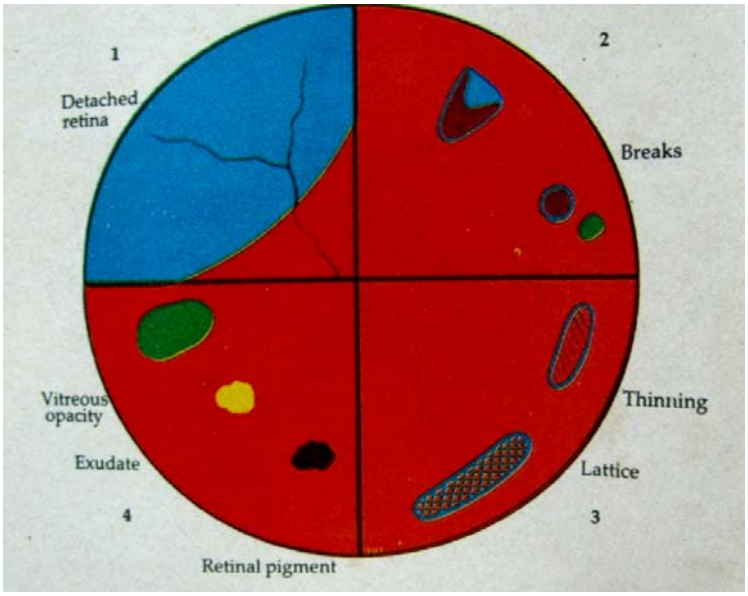
S.No	Name	Age	Sex	Hospital No.	Diagnosis	Type of Surgery
1	Sarasu	70	F	431080	LE Mature cataract	LE ECCE and PCIOL
2	Kuppusamy	70	M	436179	LE Chronic Dacryocystitis	LE Dacryocystectomy
3	Krishnamoorthy	45	M	435999	RE Mature cataract	RE ECCEand PCIOL
4	Mayilvahanan	50	M	442021	RE Chronic Dacryocystitis	RE Dacryocystectomy
5	Subramani	52	M	443532	RE Mature cataract	RE ECCE and PCIOL
6	Muthammal	67	F	435284	RE Pterygium	RE Pterygium excision with autograft
7	varadhan	53	M	443212	RE-immature cataract	RE-SICS and PCIOL
8	Balaji	28	M	446021	RE Chalazion	RE Chalazion I &C
9	Vijayan	47	M	432542	LE Immature cataract	LE SISC and PCIOL
10	Chellammal	57	F	435732	RE Lacrimal abscess	RE Incision and drainage
11	Kannammal	59	F	437636	LE Chronic Dacryocystitis	LE Dacryocystectomy
12	Isabel	60	M	432575	RE Immature cataract	RE SICS and PCIOL
13	Krishnan	62	M	432753	LE Mature cataract	LE SICS and PCIOL
14	Chinnaiyan	80	M	447007	RE Immature cataract	RE SICS and PCIOL
15	Sankari	48	F	442864	RE Chronic Dacryocystitis	RE Dacryocystectomy
16	Seethammal	56	F	445588	LE Chronic Dacryocystitis	LE Dacryocystectomy
17	Deivanai	46	F	442802	RE Immature cataract	RE SICS and PCIOL
18	Saravanan	42	M	430076	LE Chronic Dacryocystitis	LE Dacryocystorhinostomy

19	Singaram	45	M	434587	LE–Nasal pteygium	LE pterygium excision with autograft
20	Kannagi	66	F	439277	RE Immature cataract	RE SICS and PCIOL
21	Selvaraj	48	M	449174	RE Immature cataract	RE SICS and PCIOL
22	Neelavathy	68	F	443676	RE- Total RD	RE Encirlage with cryo
23	Chinnaponnu	49	F	432612	LE Chronic Dacryocystitis	LE Dacryocystorhinostomy
24	Arumugam	60	M	446412	LE Mature cataract	LE SICS and PCIOL
25	Annadurai	70	M	436277	RE Morgagnian cataract	RE ECCE and PCIOL

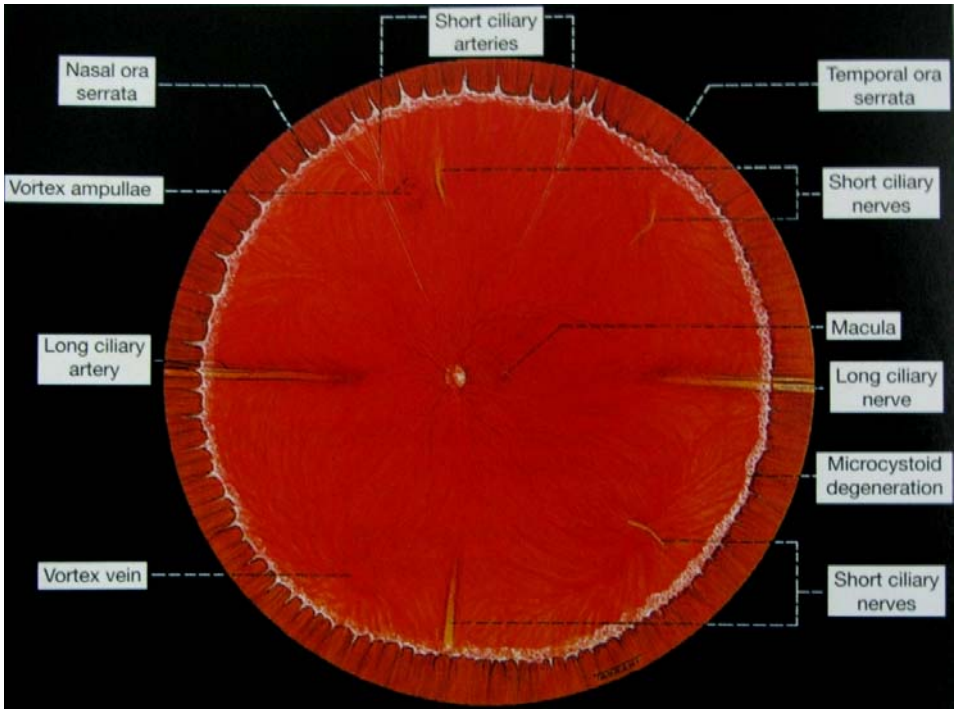
Vitreous base



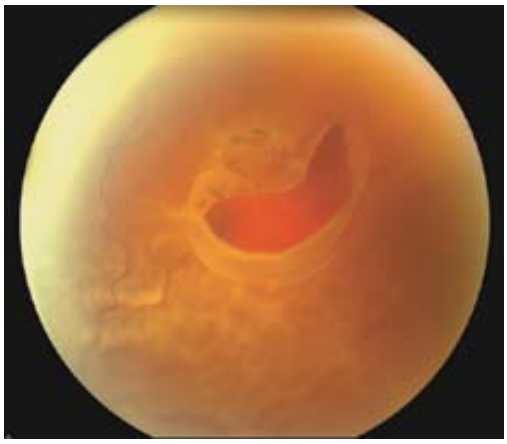
Standard colour code



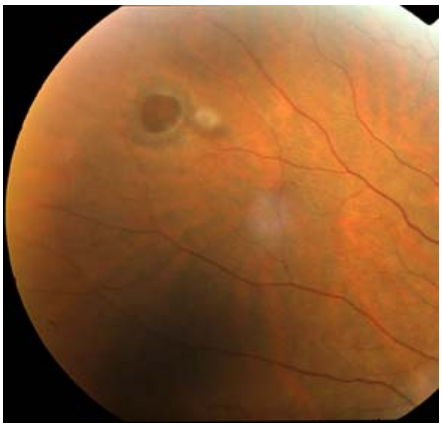
Fundus landmarks



Horse shoe tear



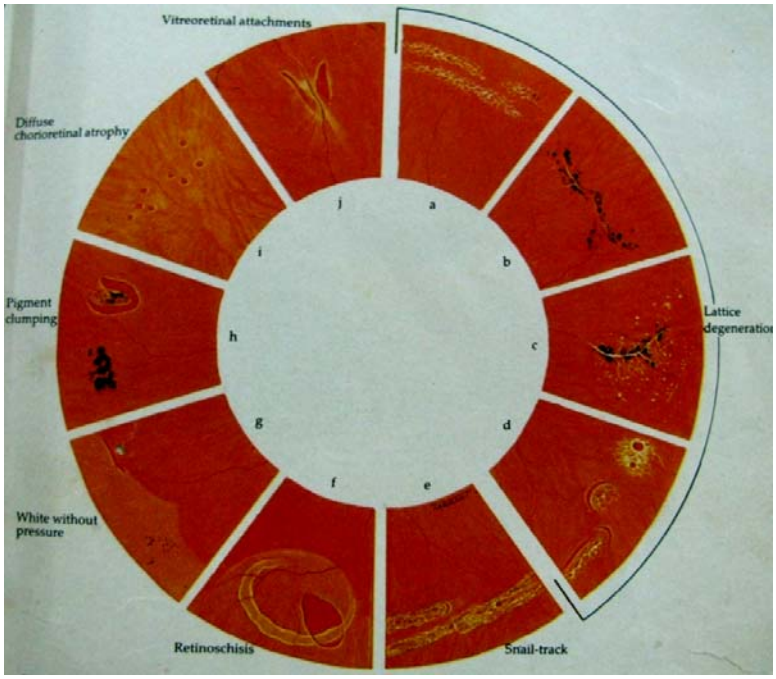
Operculated tear



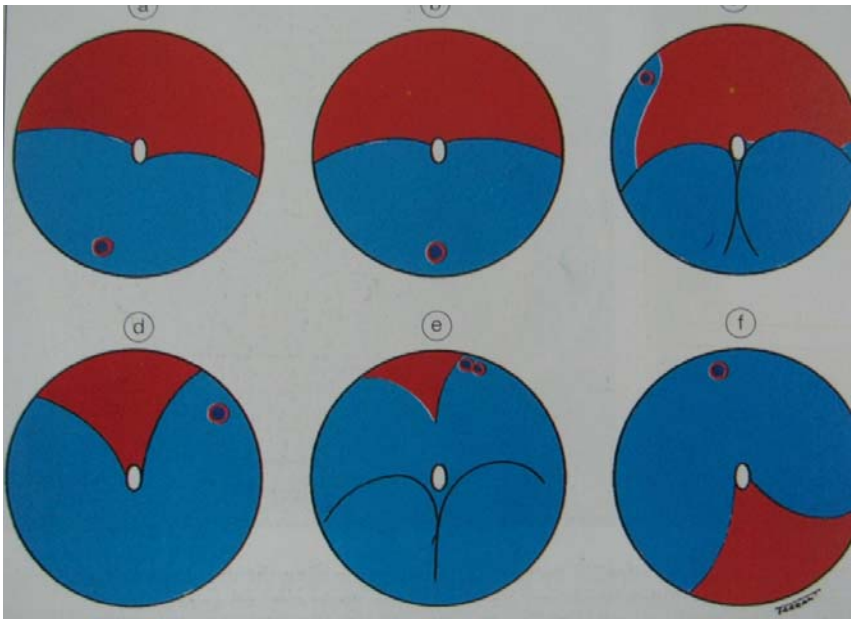
Dialysis

Irregular tear

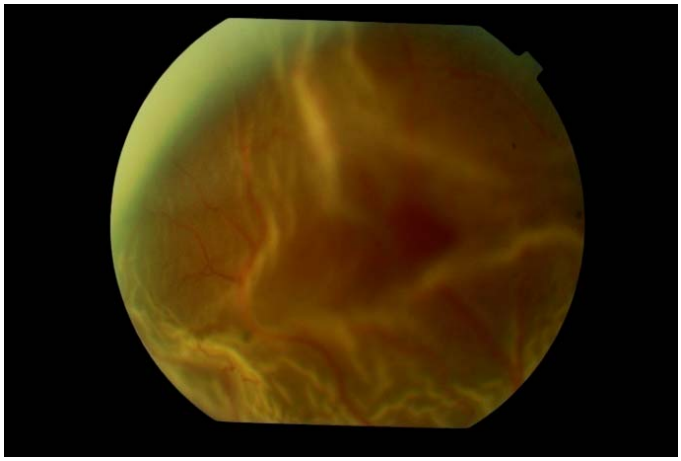
Peripheral degeneration



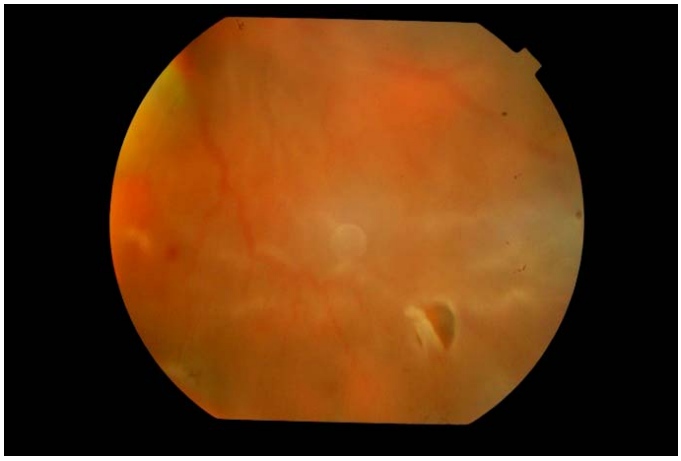
Lincoff's rule



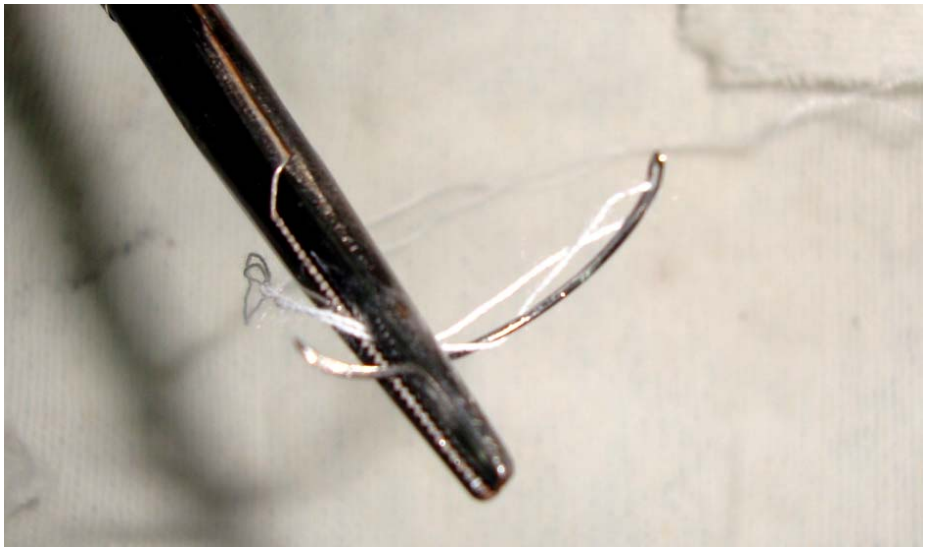
Fresh rhegmatogenous RD



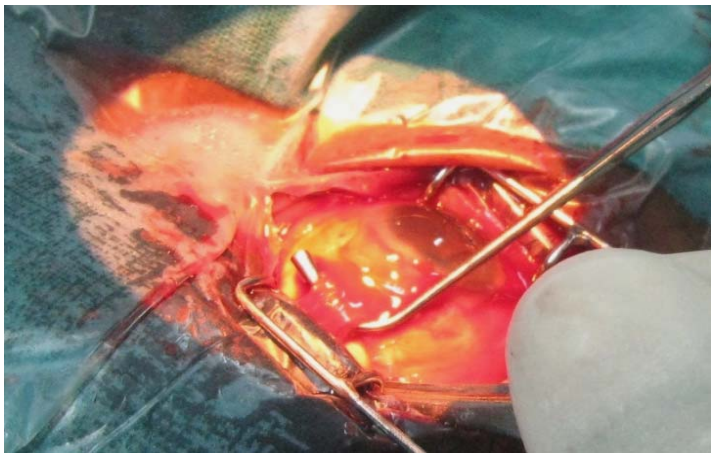
RD with HST



Instruments for Retinal detachment surgery

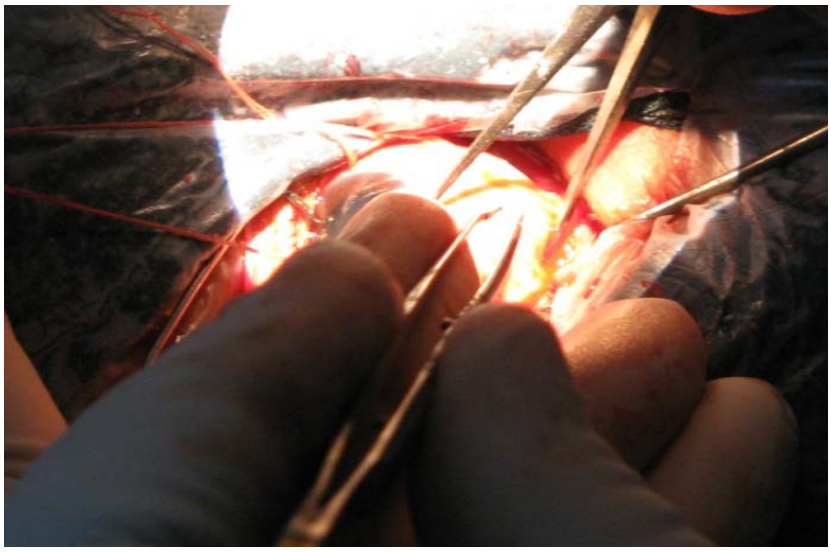


Reverse mounted needle.

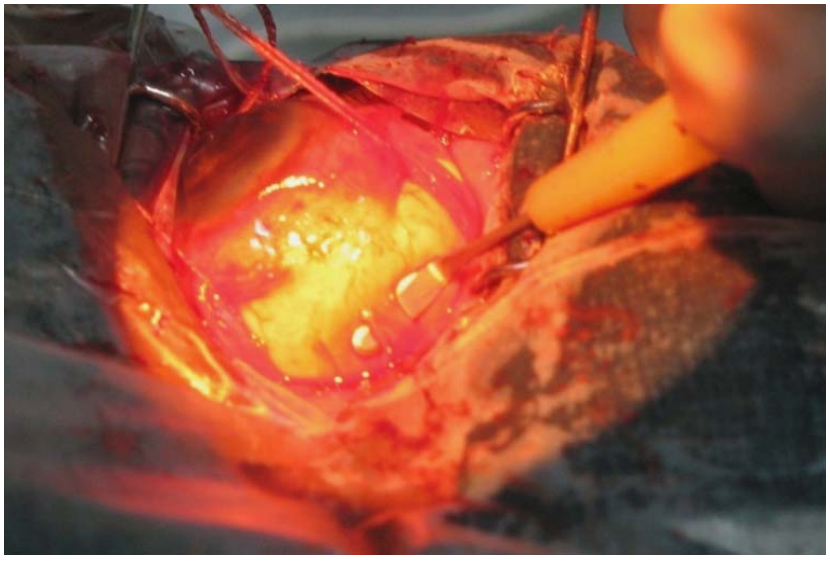


Taking bridle sutures

Ontable IDO with Cryotherapy

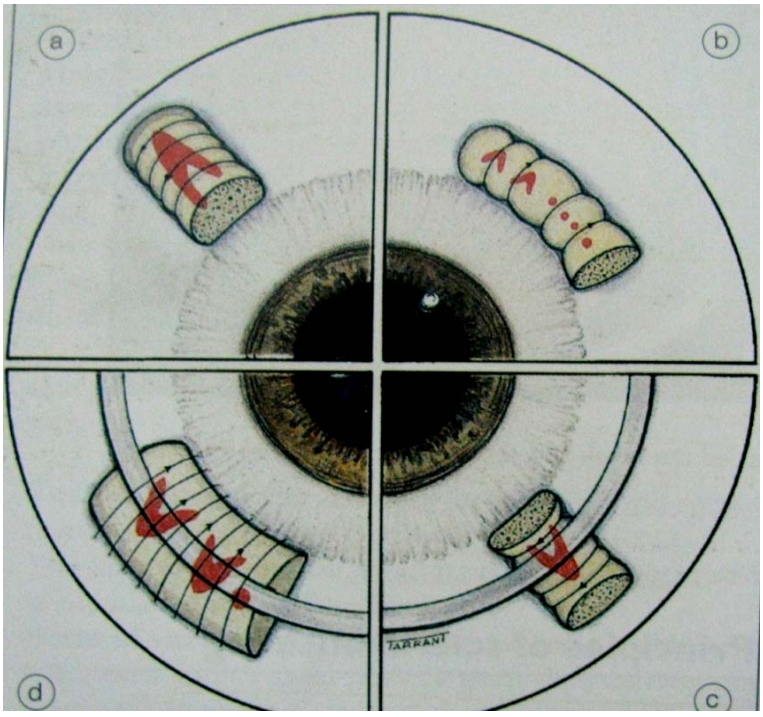


Measuring distance from the limbus

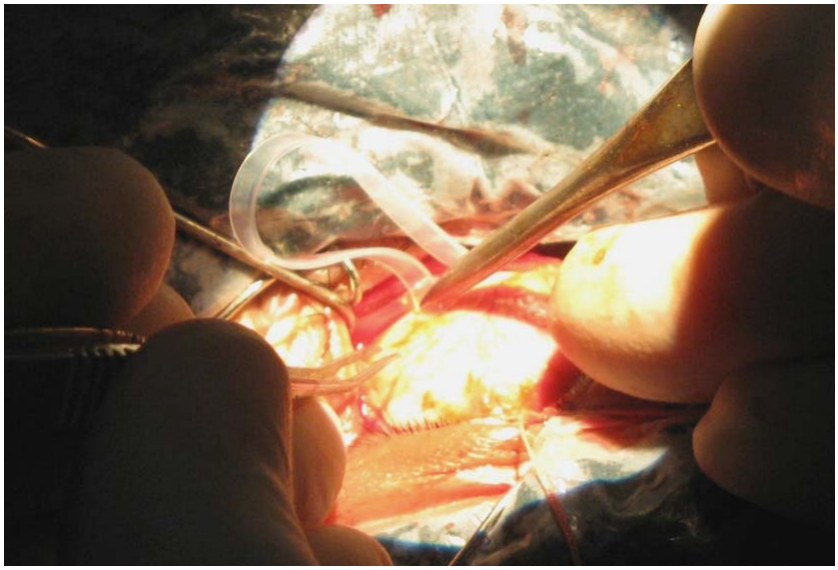


Making scleral tunnels

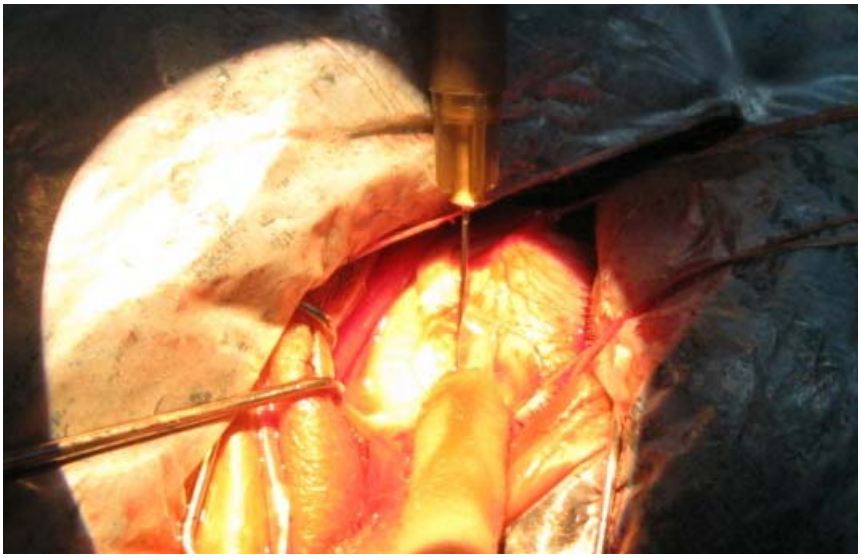
Silicon band with silicon sleeve and 4-0 ethibond suture



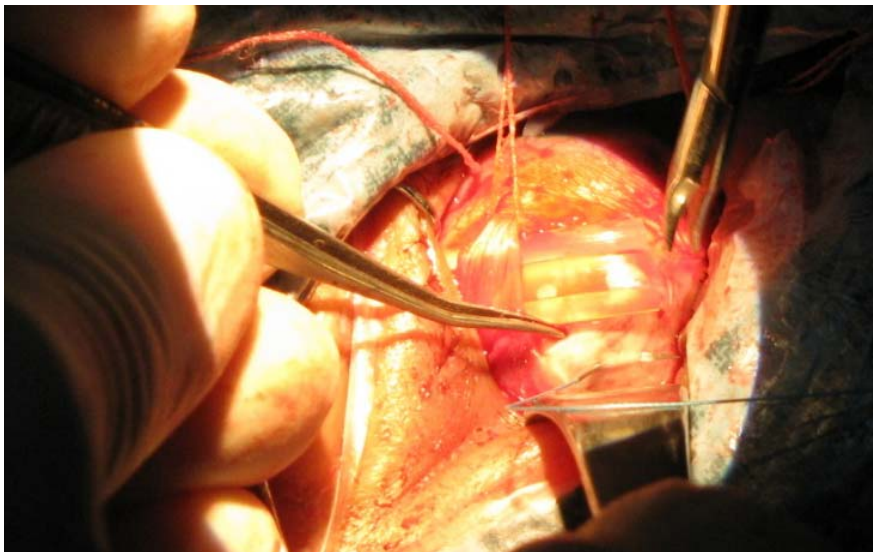
Mode of buckle placement



Encirclage in progress

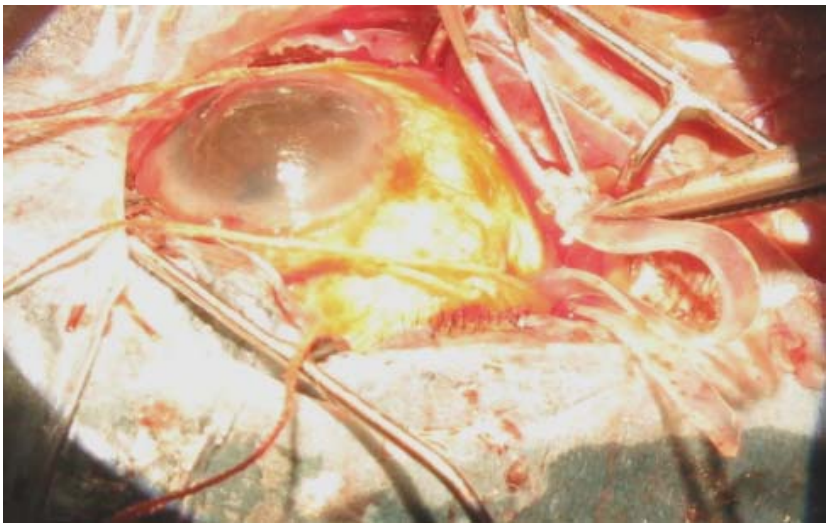


SRF drainage

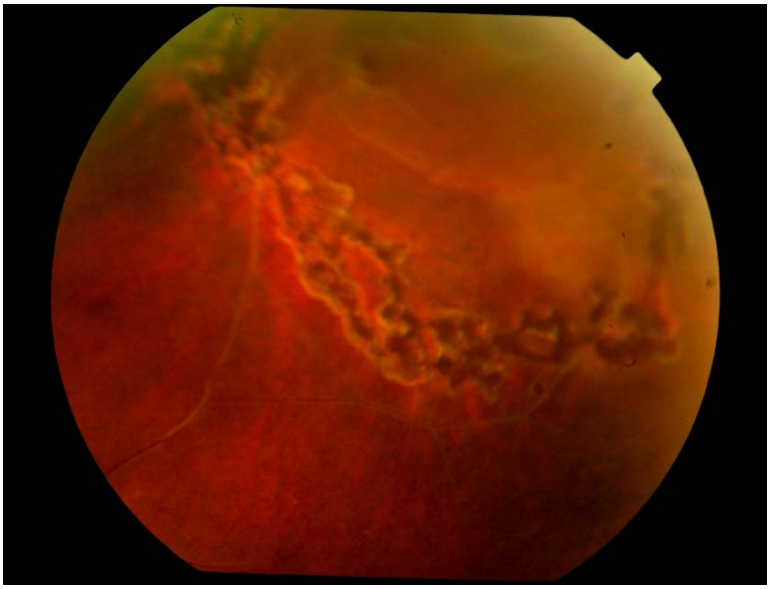


Segmental tire in place

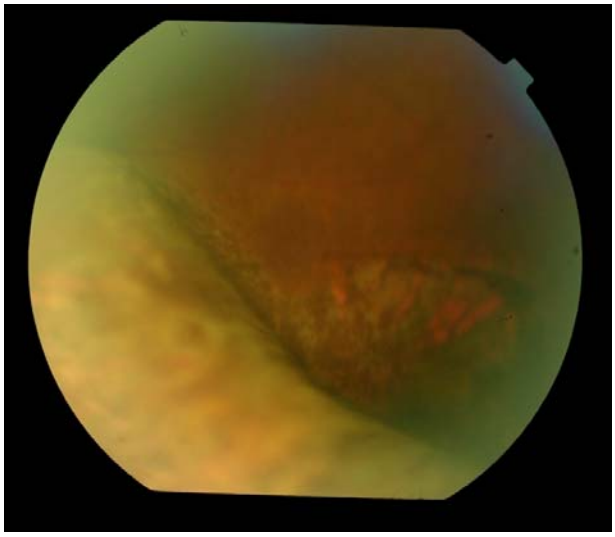
Watzke sleeve



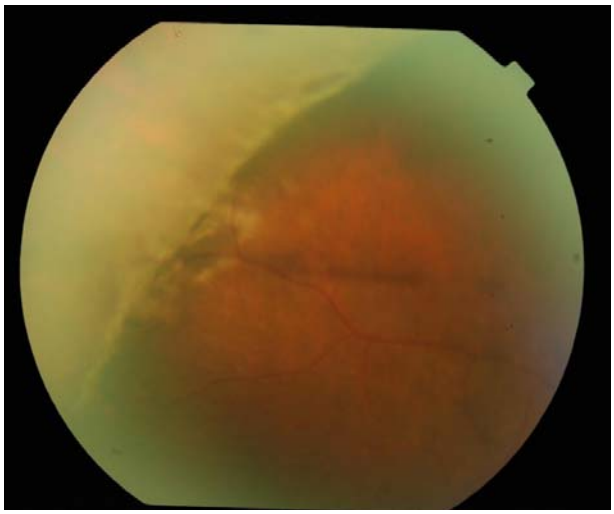
Tying encirclage ends with sleeve



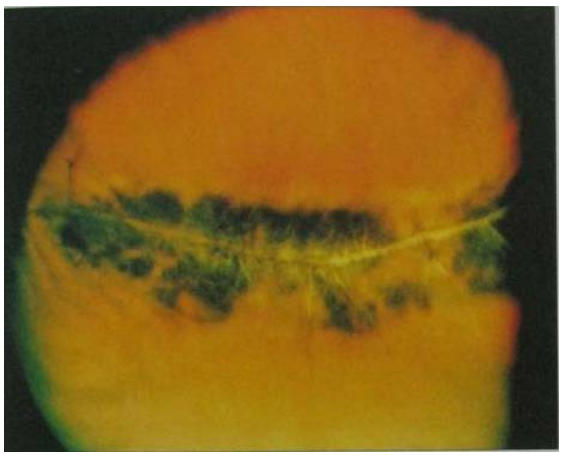
Barrage around the hole



Post RD surgery status- plomb effect due to encirclage



Cryo marks with segmental plomb effect



Lattice degeneration with pigment clumps

Operculated hole with barrage marks

in patient with fellow eye RD